FEBRUARY 14, 1955

NEWS ISSUE

Electrical World

Price 35 Cents

A McGRAW-HILL PUBLICATION

Continuing Survey Reveals Customer Attitudes to Union Electric Co

. . . Page 16

240/416-V System Offers Economy . . . . . *Page 25*

PUC's Urged to Consider Budgets in Setting Rates . . . . . *Page 40*

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UNIVERSITY MICROFILMS
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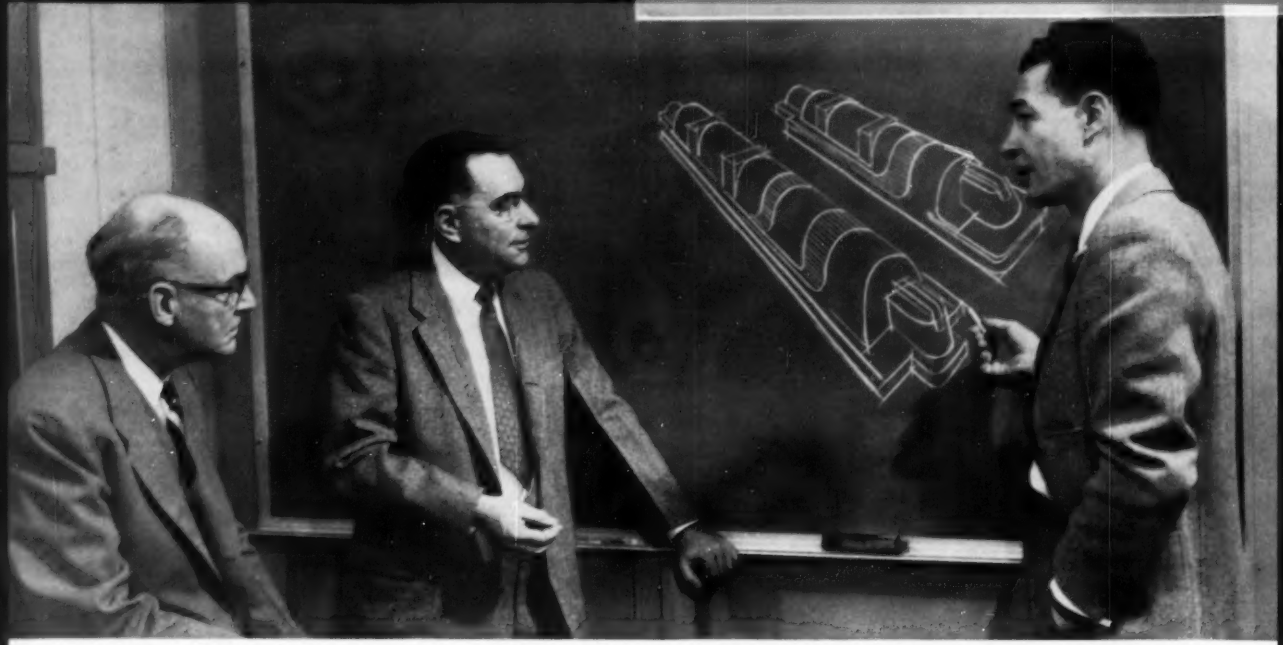

GREATER EFFICIENCY in power generation is promised by such developments as longer turbine buckets and cross-compound turbine-generator designs as discussed here by R. S. Neblett, Turbine-Generator Marketing Section, W. J. McLachlan, Mgr., Electric Utility Engineering and C. Schabtach, Turbine-Generator Engineering Section. Long-range planning typifies utility-manufacturer cooperation.

PLANNING IS KEY TO TRILLION KW-HR IN 1964

G.E. earmarks 75% of top executive time for forward planning, $165 million for expansion to help utilities reach this goal

TECHNOLOGICAL PROGRESS directed toward higher voltage systems and increased circuit breaker ratings, like the 330-kv 25-million-kva breaker above, will help utilities cut transmission costs.

LIGHTER, SMALLER distribution transformers as shown here coupled with G.E. work to up-rate metal-clad switchgear, for example, will back utility efforts to realize significant economies in distribution.

"It is our challenge to look far enough ahead in the future and to plan in time for the requirements of the future," according to Ralph J. Cordiner, General Electric president. Addressing electric utility executives, Mr. Cordiner emphasized the challenge when he added, "Planning becomes doubly important in an industry with the explosive growth potential of the electrical industry."

LOAD TO DOUBLE BY '64

What is the growth potential? Experts predict that 1964 will see the national generation reach one trillion kw-hr—double today's figure. To help utilities meet this mark, top G-E executives are now expected to devote 75% of their time to forward planning. In addition, G.E. plans a record $165 million expenditure on new laboratory and manufacturing facilities in 1955.

TEN-YEAR PLANNING ESSENTIAL

Seldon Crary, G.E., Manager—Analytical Engineering, set up a blueprint for industry-wide planning when he said, "Keeping up has always meant solving problems 10 years ahead of time." Utilities should determine their individual system needs a decade in advance of load growth. Planning of this scope takes on added importance in view of the time required for building of manufacturing facilities, designing, producing, and installing the new, more efficient apparatus that will meet these needs when they occur.

Electric utilities are to be congratulated for the long-range programming which is increasing in tempo throughout the industry. Such farsightedness and recognition of the responsibility for cooperation offer significant opportunities for them to take advantage of the better engineering and greater investment economies now available. Apparatus Sales Division, General Electric Co., Schenectady 5, N. Y. 331-281

MORE POWER TO AMERICA

GENERAL ELECTRIC

Electrical World

Vol 143 No 7 February 14, 1955

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COMING NEXT WEEK—Electrical World reports on the technical sessions of the Winter General Meeting of the American Institute of Electrical Engineers.

Alcan releases the details of the aluminum towers being used on its 300-kv Kemano-Kitimat line in British Columbia.

Published for 81 years for those engaged in the business of generating, transmitting, distributing, or applying electric power

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ELECTRICAL WORLD

Published weekly by McGraw-Hill Publishing Co., Inc., Executive, Editorial, and Advertising Offices: **McGraw-Hill Building, 330 West 42nd Street, New York 36, N. Y.** Publication office, 99-129 North Broadway, Albany 1, N. Y.

Donald C. McGraw, President; Willard Chevalier, Executive Vice President; Joseph A. Gerardi, Vice President and Treasurer; John J. Cooke, Secretary; Paul Montgomery, Executive Vice President, Publications Division; Ralph B. Smith, Vice President and Editorial Director; Nelson Bond, Vice President and Director of Advertising; J. E. Blackburn, Jr., Vice President and Director of Circulation.

Subscriptions: Address correspondence to Electrical World—Subscription Service, 99-129 North Broadway, Albany 1, N. Y. or 330 W. 42nd St., New York 36, N. Y. Allow one month for change of address.

Subscriptions are accepted only from executive, supervisory, and engineering personnel in electric utilities, manufacturing companies, and related fields. Position and company connection must be indicated on subscription orders.

Single copies 25¢. For the United States and possessions $6 a year, $9 for two years, $12 for three years. Canada, $7 for one year, $11 for two years, $14 for three years. (Canadian money, at par.) Other Western Hemisphere, and the Philippines, $15 for one year, $25 for two years, $30 for three years. All other countries $25 for one year, $40 for two years, $50 for three years. Entered as second-class matter at the Post Office at Albany, N. Y. Printed in U.S.A. Copyright 1955 by McGraw-Hill Publishing Company, Inc. Permission required to reproduce any of contents.

THIS IS A PORCELAIN BUSHING FOR A 230 Kv PRESSURE-TYPE POTHEAD

This is a one-piece porcelain, 101¼″ long, 20½″ in its widest diameter, and weighs 827 pounds. Its ends are ground, as are the conical end sections, for gasketing. The sand bands provide for attachment of mounting flanges.

Not many pieces of high-voltage electrical porcelain are produced in a single piece of this size. But in this case, the requirement is for more than a porcelain housing. This unit seals a high-pressure 230 Kv cable. To provide adequate factors of safety, it is designed for a pressure of 800 lbs. per sq. inch; each unit is proof-tested at 500 lbs. per sq. inch, and operates at 250 lbs. per sq. inch.

Only by knowledge built of experience—as to the strengths of porcelain, as well as its limitations—is a manufacturer justified in undertaking the production of such a design as this. At Lapp, that knowledge, and that experience, exist. It's evident in the proficiency with which Lapp adapts its regular production techniques to each new special requirement. It's reflected in the enthusiastic confidence with which Lapp meets so challenging an assignment.

It's a sound basis too, for the confidence of power companies the world over who have found in Lapp insulators—and Lapp "special porcelain" for system equipment—an extra margin of operating security, long life and low upkeep.

Lapp Insulator Co., Inc., Le Roy, N. Y.

Lapp

EDITORIALS

Nuclear Ash—No. 1 Atomic Headache

One of the most critical and least discussed aspects of the studies of nuclear power is the disposal of the radioactive waste after the fuel has been "burned" and particularly after reprocessing. Disposal of the ashes from coal-burning plants has been becoming a headache. But that worry is not comparable to the problem of disposing of the viciously toxic residue from a tired reactor. Unfortunately some of the ingredients stay powerfully radioactive for years after the containers in which they will have been buried or sunk deep in the ocean will have disintegrated.

Neither AEC nor any of its contractors has a complete and economical answer for the nuclear power plant which must perforce be located near population centers and not in the wilds of mountain states where some AEC laboratories are located. Burial was one of the easy disposal methods there. If disposal nearby is not tolerated by local (New York State already has a statute) or federal health authorities, then there must be transportation to some point of disposal, say a seaport. The ocean does not provide a permanent answer because the wastes from the prospective nuclear power plants of 2000 AD could require one-tenth of the entire mass of the oceans to dilute them to the point of safety for humans, to say nothing of food-fish.

Primary responsibility for researching the problem of disposal of toxic radioactive wastes impinges on the power companies who will be operating the plants. It is an operating problem, not primarily a problem for the manufacturers who are collaborating in the design of the plants. And if the utilities leave the problem to the AEC for solution, they may find the stringency of the disposal requirements will be as strong a factor as any tending to swerve nuclear power toward governmental monopoly. Access to the fuel has been established in the modified Atomic Energy Act. But the fuel will never be economical to use if it continues to cost more merely to dispose of the ash than it costs to haul, buy, store, handle, and burn the old-time fuels.

The problem is so basic and so far from a solution that heavy research guns should be trained on it. Utilities should organize and spearhead the attack.

Foreign Trade and National Security

Within recent weeks electrical manufacturers have presented their arguments before Congress against lower tariffs on foreign-made electrical equipment and machinery. They have also taken occasion to reiterate their stand in opposition to government procurement of foreign power equipment.

Arguments presented were based mainly on military and economic considerations. It was noted that foreign manufacturers pay their employees only 1/10 to 1/3 the wages paid by U. S. producers. On equipment having a large labor content, the foreigners are able to undersell domestic manufacturers by up to 30% after paying present duties and shipping charges.

One manufacturer proposed a tariff schedule on such equipment which would approximately equalize the difference between wages paid by domestic industry and that paid by foreign industry. Other spokesmen limited their opposition to any lowering of the present tariff.

It was charged that the federal government in a recent case lost more in income tax by not awarding an equipment bid to an American concern than it gained by buying at a lower price from a foreign firm.

Policies which tend to shift orders from domestic to foreign firms, whether they involve lower tariffs or government procurement of foreign goods, weaken this country's industrial preparedness, say the domestic manufacturers. First there is less guarantee that equipment ordered abroad will meet performance standards, that it will be delivered promptly and that it will be adequately serviced. Second, unless American productive capacity is expanded through increased orders, it will not be prepared to cope with an emergency in which foreign supplies are cut off.

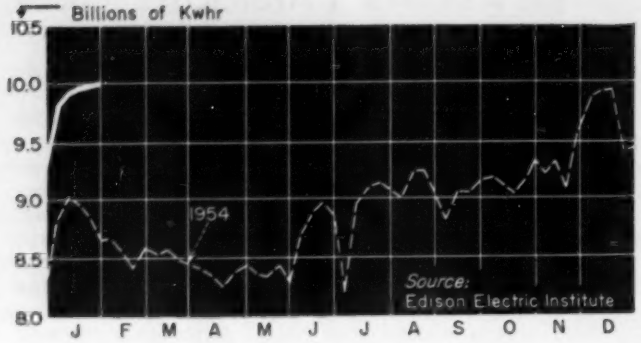
Large and small manufacturers are standing together in opposition to proposed trade policies which they believe will damage and perhaps disrupt American capacity to produce vital electrical equipment. They view these policies as a threat to American industrial preparedness and hence a threat to the national security.

Congratulations, OVEC

From drawing boards to operation in just over two years! That's the record for the first two 200,000-kw units at Ohio Valley Electric Corp's Kyger Creek and Clifty Creek steam stations. These two units are now serving the U. S. Atomic Energy Commission plant at Portsmouth, Ohio (Jan. 31, p32). Electric companies in OVEC are also supplying AEC from present systems.

Here is an accomplishment of which the industry and all of free enterprise can be proud. What better argument is there for the speed and dependability of electric companies than a deed such as this. The 15 operating companies which comprise OVEC are serving their nation well.

THE ELECTRICAL WEEK



OUTPUT

Week Ended Feb. 5

10,047,000,000

Up 15.8%

Per Cent Change from Previous Year

	Total US	New Eng.	Mid. Atlan.	Cent. Ind.	West Cent.	South-east	South Cent.	Rocky Mount.	Pacific NW	Pacific SW
Feb. 5	+15.8	+9.3	+9.0	+15.3	+9.2	+27.5	+12.0	+12.0	+10.8	+15.6
Jan. 29	+13.0	+5.1	+5.8	+12.5	+5.2	+28.6	+7.2	+9.3	+5.3	+9.1
Jan. 22	+11.2	+3.9	+4.6	+9.4	+3.0	+25.3	+8.5	+7.3	+5.0	+10.0

Seasonally Adjusted Index 184.1 Week Ago 182.4 Year Ago 158.6

The Issue's News Highlights . . . Avalanche downs 300-kv Kitimat lines, halting production at giant smelter of Aluminum Co of Canada at Kitimat, B. C. . . . Securities and Exchange Commission by a 4 to 1 vote approved the Dixon-Yates financing plan . . . Walker Cisler tells Joint Committee that U. S. prices for nuclear by-products offer no incentive for investors . . . Tariff aid is sought by equipment manufacturers, who warn of growing threat of low-wage foreign competition.

Wisconsin Public Service has elected Harold P. Taylor, senior vice president and treasurer, president to succeed Charles E. Kohlhepp who has resigned effective April 1 to become president of Jersey Central P&L (see also p 43) . . . FPC has granted Pacific G&E license for three power plants on North fork of Feather River. Project will cost $74 million and develop 258,000 kw.

American G&E has placed in operation its giant transmission penalty factor computer, manufactured by General Electric in cooperation with AGE. Utility expects to save up to $100,000 a year on power losses as result of the analog computer.

Maine Democratic State Sen Alton Lessard introduces bill in legislature to delete words "current value" in PUC's rate formula. Also introduced is bill to repeal Fernald Law which prohibits export of surplus hydro power from state . . . Vermont public utility and other interests agree on granting PSC authority to contract for transmission of St. Lawrence power into Vermont.

University of Michigan offers two-week course for engineers without previous experience in nuclear technology. It will run from Aug. 15 to Aug. 26 . . . Puget Sound Utilities Council has agreed on terms of contract with AEC for study of nuclear power reactor.

Pittsburgh is leading claimant for new engineering societies headquarters. Special committee of the five societies—civil, mining, mechanical, electrical, and chemical—has turned down New York and Chicago sites and recommended Pittsburgh . . . Power production establishes another new high (see chart) in week ended Feb. 5, 15.8% above year ago. This was biggest percentage rise since March 3, 1951.

NEMA is retiring its membership on Inter-Industry Farm Electric Utilization Council. It says it can best serve council aims in consulting capacity through its Farm Load Development Committee . . . Canadian GE and Canadian Westinghouse each will supply eight generators for Canadian section of St. Lawrence powerhouse.

NEWS OF THE INDUSTRY BRIEFLY TOLD

Off the Washington Wire . . . AEC is negotiating to buy 165,000 kw more power from OVEC than amount for which original contract called . . . In reply brief to FPC on Hells Canyon, Idaho Power contends opponents have presented no evidence to dispute economic superiority of three-dam proposal and have based their whole argument on public-vs-private power issue. Proponents of federal development say that FPC's staff brief (favoring three dams) is urging "cynical" bypassing the law.

Hartford Electric Light arranges with Connecticut Power that when purchasing power, net payment after transmission costs will be handled as a credit to production expense rather than as an operating revenue . . . Connecticut L&P will spend record $33 million on construction this year . . . New Hampshire Gov Lane Dwinell proposes $60,000-a-year assessment on public utilities to help pay expenses of PUC.

South Carolina House Ways and Means Committee has approved a resolution for a General Assembly investigation of the finances of Santee-Cooper.

Union Electric of Missouri has launched "Reddy Credit Plan," to provide long-term financing to residential customers for purchase and installation of major appliances, and for home rewiring. Thirty local banks finance the plan and receive $5 for each installment purchase handled from Union Electric. Customers are allowed 36 months to pay with purchases limited to $150 minimum and $435 maximum.

Battelle Memorial Institute has awarded American Machine & Foundry contract for design, engineering and construction of nuclear reactor for new $1.5 million research center in Columbus, Ohio. AMF has also completed plans for a nuclear reactor for research and has invited number of firms to participate in program on cooperative basis. Project is planned for New York area.

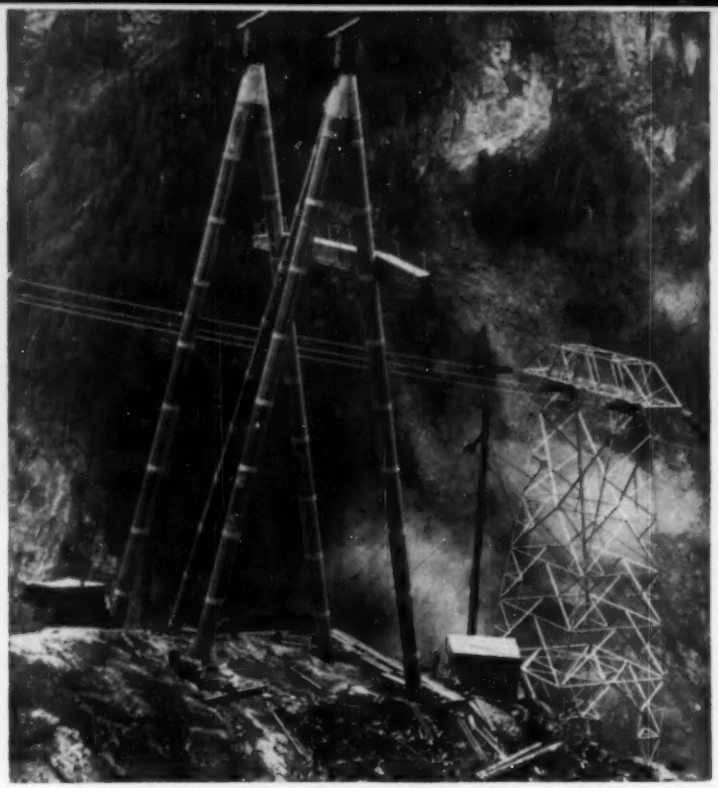
Utility managements "are alert to possibilities of atomic power," Eldred H. Scott, controller, Detroit Edison, told New York Security Analysts. There are numerous groups experimenting with different reactor designs, he noted. "The great electric utilities of today have been built on research and private initiative. In this new medium of production the investor can be assured that his investment will not be wiped out overnight by obsolescence . . . Atomic power will be a boon to present and future utility securities," said Scott.

ABOUT PEOPLE IN THE INDUSTRY

From here on, "atomic energy will come cheap and quickly if we establish wise public policies, and if we are willing to make the public investment, or it will come slowly and will cost much more if we permit private monopoly, with its hesitant investments and arrogant profiteering policies to dominate the field," Clyde T. Ellis, executive manager, tells NRECA convention this week. "The more our country is willing to invest at this time, the more quickly will this new, low-cost electric energy become available."

Electrical industry "is still a young, vigorous and growing industry," says General Electric Chairman Philip D. Reed. "Its rate of growth will be, in part, a function of the efficiency of our operations, reflected in wide availability and low cost of electric power, and also in part on the ingenuity of ourselves and others in finding ever new and ever more uses for that power. . . . There can be no question that demand for power will broaden and deepen with each passing decade," he adds.

More News About People page 43



Aluminum and steel transmission towers like these were torn loose at Kildala Pass in British Columbia

Avalanche Downs 300-Kv Kitimat Lines

Production at the giant smelter of Aluminum Co of Canada at Kitimat, B. C., has been halted following a "one-in-a-million" avalanche in the storm-whipped Kildala Pass that severed both transmission lines feeding power to Kitimat from Kemano.

Engineers and line crews are working around the clock in a helicopter-directed operation in an endeavor to link up the power lines which broke when three towers—two aluminum and one steel—were torn from their moorings by tons of snow, water, and ice that cascaded across the face of the mountain in a "freak" snow-slide late in January.

While no ingots have been produced since the break, there has been little slow-down in working force of 1,200 men as they have been busy chipping the metal out of the "frozen" pots so that production may be resumed as soon as possible after the power is restored.

Here is the way break occurred:

The transmission lines feed power to Kitimat from Kemano, 51 miles, by crossing an intervening mountain range via the 9-mile long Kildala Pass, the only pass which afforded suitable tower sites and reasonable access.

Through the pass, the two high-voltage transmission lines are single-circuit, one carried by conventional steel towers, and the other by the uniquely designed and constructed aluminum towers. The latter will be described in an article to appear in EW, Feb. 21.

Both lines on the Kildala Pass section of the 300-kv Kemano-Kitimat system carry the same 3,364-MCM ACSR conductors.

Through the pass both single-circuit lines run side by side on the western face of the mountains, but because of the rugged topography, they are not parallel. The left-hand (aluminum) and right-hand (steel) lines occasionally approach each other so that only minimum acceptable center-to-center separation exists.

The break occurred where the lines were running close to each other about half way up the mountain face. The winter snows had filled in all the ravines and gullies so that the mountainside had turned into a smooth face.

Then unseasonably mild weather melted the top crust of the snow which in turn froze again creating a massive ice-sheet down the side of the slope.

More snow fell on top of this. Then it rained, and the "impossible" happened. The rain loosened the snow, and with nothing to hold it back, it started moving en masse over the ice-sheet beneath it.

Precautions had been taken when installing the towers to meet an ordinary downward snowslide. But this one moved across the face of the mountain in a diagonal path, gaining terrific weight as it moved forward until it engulfed the towers of both transmission lines, even burying the cables themselves in the snow.

Engineers report that such a "freak" situation would probably never recur. They point out that the aluminum towers, during their operation so far, have lived up completely to expectations. They believe such towers will find wide use where their light weight simplifies transportation and their streamlined contour will reduce snow, ice, rime, and wind loads.

SEC OK's MVGC Financing

Commission gives go ahead signal to Middle South-Southern Co subsidiary on its stock plan for West Memphis, Ark., plant.

Securities and Exchange Commission last week approved Dixon-Yates' equity financing plans. Chairman Ralph Demmler and Commissioners Adams Armstrong, and Goodwin voted for it and Commissioner Rowen dissented.

The Dixon-Yates firm, Mississippi Valley Generating Co, had asked SEC to permit it to issue all of its 55,000 shares of common stock to Middle South Utilities, Inc, and the Southern Co, to provide $5.5 million in equity capital for the new steam plant at West Memphis, Ark. Energy will replace power Tennessee Valley Authority supplies to Atomic Energy Commission's Paducah, Ky., plant.

Rebuff for Intervenors . . . SEC earlier refused to reopen the record of its hearings on the matter at request of intervenors. Attorney Joseph Volpe, representing Tennessee, had asked that the record be reopened in light of a resolution of the Democratically controlled Joint Atomic Energy Committee, which had rescinded its vote of approval of the contract and stated that it was not in the public interest. SEC said the Joint Committee's action "did not represent a change of circumstances of a nature sufficient to reopen the record."

Joint committee chairman Clinton P. Anderson (D-N.M.) disagreed. He declared the committee had no power to approve the contract last session, and that only after SEC approves its financing plans, should it come before the Joint Committee for review.

Other developments last week:

• Atomic Energy Commission Chairman Lewis Strauss revealed in a letter to Sen Albert M. Gore (D-Tenn.) that the commission had voted 2 to 1 to reject Democratic demand that it cancel the Dixon-Yates contract. Strauss and Dr Willard F. Libby voted to stand by the contract. Thomas E. Murray voted for its cancellation.

• Senator Anderson said the commission vote "simply means we will have to go ahead with other measures" to kill the power deal. The New Mexico senator indicated that the Democrats will seek to withhold funds for the project.

• The Joint Committee released a report containing majority and minority views of the members as constituted during the last Congress. Republicans, who backed the contract and put through the vote of approval, said the Dixon-Yates proposal was the best alternative to the "socialism" of having TVA expand to supply AEC its power. Democrats said AEC should not be in the power business, and that the contract was "found wanting as a business proposition."

SENATOR HILL opposes giving a "single penny" to AEC or TVA for MVGC contract

• Sen Lister Hill (D-Ala.), a Dixon-Yates opponent, was named chairman of a new Senate appropriations subcommittee which reviews both AEC and TVA funds. He said he will oppose giving a "single penny" to either agency for the contract.

• The Senate Republican Policy Committee prepared and circulated a memorandum advising Republican senators that the contract is "far more favorable to the government" than those with Ohio Valley Electric Corp and Electric Energy, Inc, which also supply AEC power and which were negotiated under a Democratic Administration.

Utility Industry Is Behind You, Quinton Tells Dixon

Harold Quinton, president, Edison Electric Institute and Southern California Edison Co, sent the following telegram to Edgar Dixon, president of Middle South Utilities, Inc, Feb. 2 (EW, Feb. 7, p 55).

"I note in the press a suggestion that the electric utility industry prevail upon you and [Eugene A.] Yates [Chairman of Southern Co.] to cancel the power contract between the Mississippi Valley Generating Co and the Atomic Energy Commission.

"I want to state that the investor-owned electric power industry wholeheartedly supports the basic philosophy of the government in calling on private enterprise to perform those jobs which it is willing and able to do. Judging by newspaper articles and editorials, the press also generally favors this philosophy. I am certain it is the general opinion of the electric industry that the Mississippi Valley Generating Co contract with AEC is a splendid example of cooperation between private citizens and the government. The government will be able to buy power at favorable rates for a long-term of years, and taxpayers will avoid a construction expenditure of some $100 million.

"This contract represents the third occasion on which the AEC has made a long term contract for purchase of a large block of power from a company sponsored by business managed utilities and financed entirely with private capital. The rates to the government under this contract have been found by qualified experts to compare favorably with those under other AEC power contracts.

"You and Yates and the electric utility organizations you represent are doing a splendid service in the public interest in standing firm on the Mississippi Valley Generating Co contract."

AEC Faces Fuel Cost Headache

Walker Cisler tells Joint Committee U. S. prices for nuclear by-products provide no incentive for investors

Problems under the Atomic Energy Commission's new industrial participation plan have begun cropping up even before its details have become public.

Walker Cisler, president of Detroit Edison Co and chairman of the Management Committee of Atomic Power Development Associates, pointed last week to one of the touchiest—prices the government will pay for weapons-grade by-products produced by licensed private power plants. Cisler said these are so low they will not provide incentive for private investors to get into the business. He said they are about half what they were expected to be.

Prices Are Classified Data . . . The price schedules—that is, prices the government will pay for plutonium, and fees it will charge for "loan" of nuclear fuels to power private plants—are classified information, and will be made available only to security-cleared industrial personnel.

AEC did not reveal its price lists in open session, but it did explain last week to the Joint Congressional Committee on Atomic Energy the factors on which its schedules are based. Commissioners said planned expenditures for weapons materials will not be increased for the benefit of nuclear power, that deductions will be made if processing of special nuclear materials is necessary, and that base payments by the government will be guaranteed for seven years except for fluctuations based on labor department indexes. For the fuels it "rents," prices will be based on a guarantee of fuel availability for the period of a license, and on cost of fuel to AEC.

The commissioners said the basic lease or use charges for fuels will be computed at 4% per year of the established values of the material. Licensees will be charged full cost for all special nuclear materials consumed or lost while in use, and will be responsible for fuel element fabrication and chemical recovery of spent fuel elements, although AEC will continue to do this until industry can assume burden.

Other headaches in the new program include:

• The seven-year limitation on AEC's ability to guarantee plutonium prices. AEC Chairman Lewis Strauss told the Joint Committee he did not believe such a limited guarantee of income would enable private firms to obtain financial backing for proposed enterprises.

• Declassification of highly restricted atomic data to the new "gray area," to be made available to industrial participants. Former AEC Declassification Chief James G. Beckerley testified that all reactor technology should be included in the gray area. He warned that information control is a dangerous government pastime, and that it will handicap industrial development. AEC is retaining under strict secrecy, all reactor technology connected with the weapons program.

• Insurance of atomic risks. This has been called the most serious deterrent to participation in a large-scale private atomic energy industry. Insurance executives are now studying AEC reports to determine how much they can risk in underwriting liability for atomic hazards.

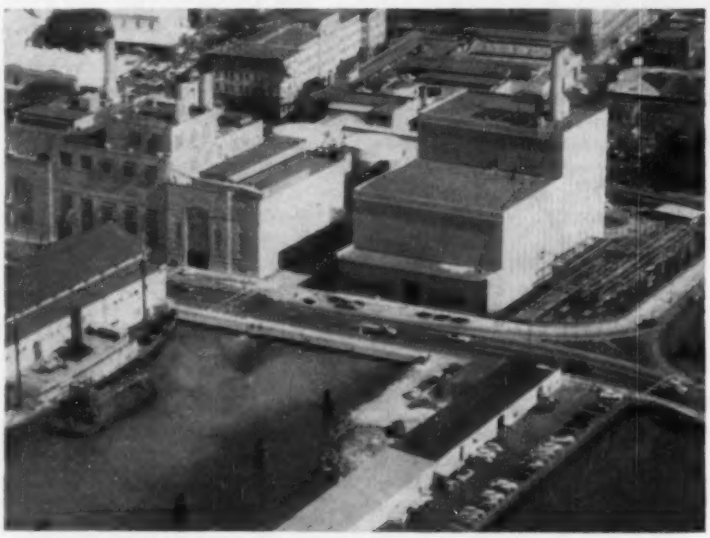
Other aspects of AEC's new program:

• **Licensing**—There will be licenses issued for operators of licensed facilities, and for the production and utilization facilities themselves. In addition, there will be accompanying regulations covering distribution and use of special nuclear materials by such licensees, health and safety rules, security requirements, controls on by-products, and internal AEC rules.

• **Patents**—AEC has revised its patent rules to conform to the anticipated greater participation by industry. It now has four types of patent clauses:

1. Type A, which provides for AEC determination of any rights in and to an invention, and which is used in

(*Continued on page* 63)



Hawaiian Electric's $10-Million Addition

Hawaiian Electric Co's $10-million power plant addition on Oahu will be dedicated Feb. 25. The 50,000-kw facility (pictured above at the right adjacent to original plant) increases available power on the island by 23%. It was put in service Dec. 17.

The plant's modern features include a closed-circuit television screen for viewing the interior of the furnace while in operation. The new addition, located within the city limits, is faced with vertical concrete panels divided by yellow aluminum louvers.

NEXT: GASEOUS INSULATION

An entirely new concept—*gas* as a power transformer insulation and coolant—is now being used by General Electric engineers at Pittsfield, Mass. The gas is sulphur hexafluoride chosen because of its high dielectric strength.

Lighter, quieter, safer . . . these are the predictions for this revolutionary design, a joint project of G.E. and the Consolidated Edison Company of New York. Above is a model of the 2000-kva, 69-kv units now being built.

Gas-insulated transformers will be ***safer*** because sulphur hexafluoride is non-flammable; ***quieter***—because pressurized gas conducts sound far less readily than liquid; ***lighter and more compact***—because the gas will eliminate heavy liquid insulation. General Electric Company, Schenectady 5, N.Y.

421-27

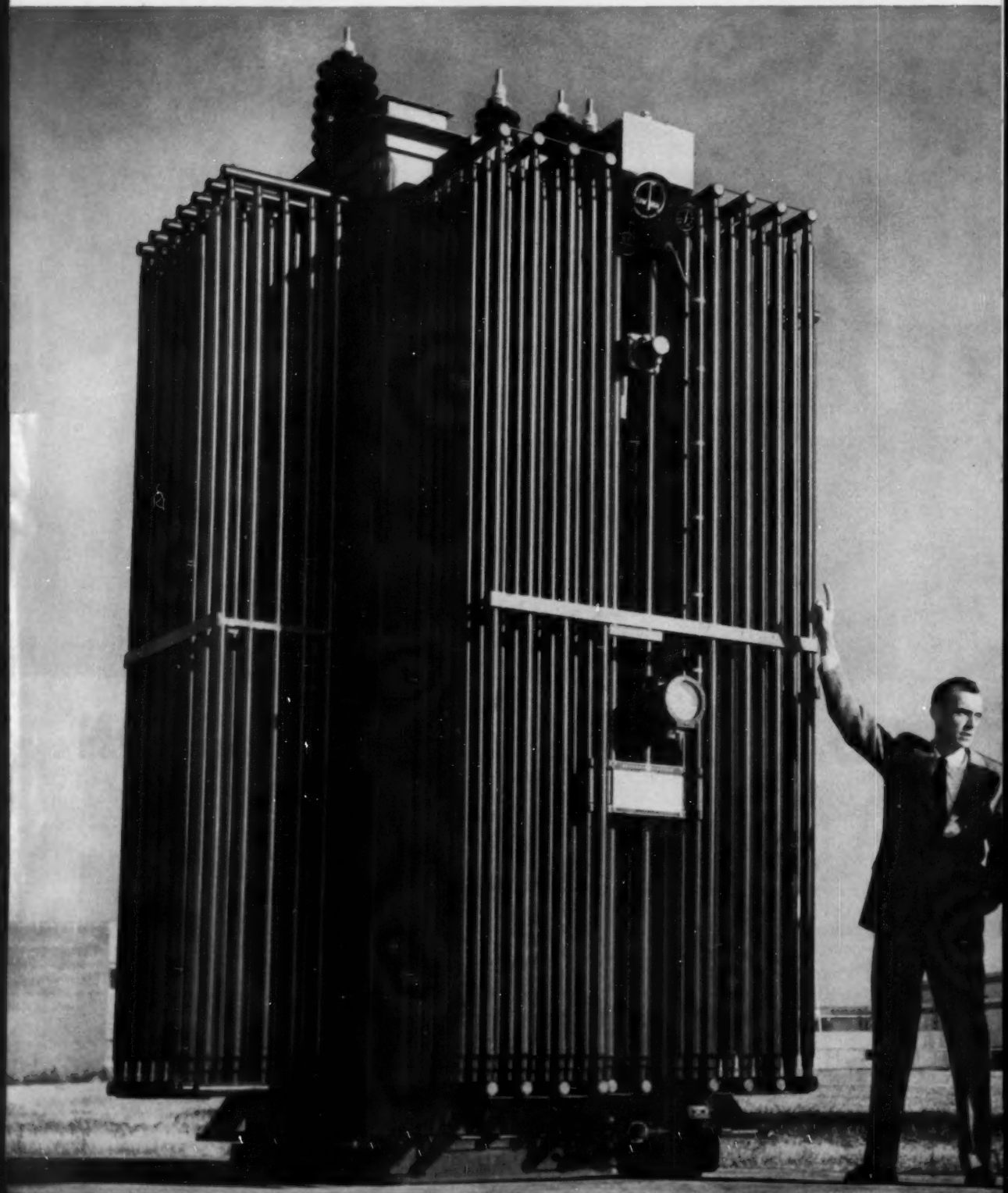
Power Transformer NEWS

Progress Is Our Most Important Product

GENERAL ELECTRIC

ANNOUNCING

the new 1955 G-E



RM power transformer

A COMPLETELY RE-DESIGNED TRANSFORMER... WITH INSTRUMENTS GROUPED IN ONE EASY-TO-READ CONTROL CENTER . . . PLUS MANY OTHER NEW FEATURES YOU'VE ASKED FOR

Now a complete re-design of General Electric's entire RM (Repetitive Manufacture) line of power transformers brings you many new features that mean easier installation, less maintenance and longer life.

In the new 1955 line of RM transformers, for example, all instruments are grouped in one convenient location. Called the "control center," this unique arrangement improves visibility and simplifies maintenance. Recessed behind the cooling tubes, all accessories including the tap changer operating handle are protected against accidental damage. All are safely accessible even with the transformer energized.

Many new money-saving features of G.E.'s 1955 RM transformer line resulted from product planning meetings with more than 75 electric utilities. Such things as American Standard bushings, weather-tight conduit, extra jacking space, and prefitted arrester-to-bushing connectors were first suggested by the men who actually use and install transformers.

The 1955 line has also been re-designed to give you a transformer of even greater reliability. Use of Formex* wire, for example, results in a smaller, lighter, yet more dependable unit. All single-phase transformers feature improved performance because of Spirakore* construction which gives you the full benefit of the directional properties of grain-oriented steel.

Your acceptance of power transformer standardization has made this new transformer possible. Available in ratings 501 to 5000 kva single phase and 501 to 10,000 kva three phase, 69 kv and below, 1955 RM transformers are being built at Rome, Georgia, on the nation's only real "mass production" line for power transformers. To see how these new transformers can benefit you, just get in touch with your nearest G-E Apparatus Sales Office or write for Bulletin GED-2505. Address your request to Section 416-1, General Electric Company, Schenectady 5, New York.

*Reg. trademark of General Electric Company

Progress Is Our Most Important Product

GENERAL ELECTRIC

Buy Proved Insulator Performance

...it's WORTH the price!

LOCKE

LOCKE DEPARTMENT
GENERAL ELECTRIC COMPANY
BALTIMORE, MARYLAND

Equipment Makers Ask Tariff Aid

- **Manufacturers state electrical equipment "absolutely necessary for defense"**
- **Hydraulic turbine maker sees company threatened with disaster**
- **Porcelain insulator industry protests low-wage Japanese competition**

Electrical equipment manufacturers again appeared before the House Ways and Means Committee last week to urge careful consideration of any trade liberalizing proposals, lest United States defense potential be damaged.

Manufacturers of porcelain insulators, hydraulic turbines, and other equipment, all warned of the growing threat of low-wage foreign competition in the domestic market.

A. F. Metz, chairman of Okonite Co, spoke on behalf of over 50 companies, many of them leaders in their fields. His statement to the committee urged that action be taken to protect "completely" manufacturers of electrical power and communication equipment as "absolutely necessary for defense, security and welfare."

The companies signing the brief, said Metz, "make products which have labor cost of 30% or more of total cost and foreign competition is based on rates from one-tenth to one-third of our labor cost. The differential cannot be made up by any labor saving machinery which has not been made available to foreign manufacturers nor can any management technique overcome both this hurdle and that of high taxes."

Metz recommended "equitable tariffs and quotas" for foreign items not necessary for defense and subject to substandard elements of cost "which cannot be offset by mass production technique." The U. S. should furnish marketing and selling techniques to other countries which have too much productive capacity, he said. And, he continued, it should encourage in world trade "the same commercial atmosphere that now exists between our (48) states."

Turbine Competition Keen

Burwell B. Smith, vice president of S. Morgan Smith Co, said because of the cut in tariff protection "we can no longer compete in the presently limited domestic market" for hydraulic turbines.

The hydraulic turbine industry in the U. S., said Smith, has had to depend largely on the government for its market. From 1933 to 1953, government purchases of hydraulic turbines accounted for about 75% of the sales of this equipment. As a result of the tariff reduction, the price differential protection of the Buy America Act has been reduced from 25% to 6%. "Consequently, when our foreign competitors desire to quote prices here which are comparable to the prices that they now offer in other world markets, there will be no way for us to stay in business," said Smith.

Smith cited these factors working against domestic companies in the U. S. market: (1) Differentials in labor rates (anywhere from 66% to 90% greater for U. S. companies); (2) necessity to comply with such laws as Buy American Act, Renegotiation Act, Walsh-Healy Public Contracts Act, and others, and (3) necessity of paying overtime premiums, social security taxes, holiday pay, pensions, insurance, etc, which are customary in the United States.

There are only five manufacturers of hydraulic turbines in U. S., said Smith. Of these, two are devoted primarily to the manufacture of this type of equipment. If they cannot compete for domestic sales to their own government, "then two of these five American producers, my company and James Leffel & Co, will probably be forced completely out of business."

Hit Japanese Insulator Order

Ralph L. Jenner, president, Lapp Insulator Co, Inc, and Leo B. Harvey, president of Porcelain Insulator Corp, testified on porcelain insulators. Harvey also acted as spokesman for the independent manufacturers in this industry.

Both speakers were critical of the recent order for Japanese insulators for Bonneville Power Administration. "To add to the injustice of the situation," said Jenner, "I might point out that this was done at a time of reduced business when the industry was forced by lack of orders to reduce hours of labor and lay off employees."

Jenner noted that the labor content of cost in the high voltage electrical porcelain industry is about 70%. "Under these conditions we cannot survive the tremendous difference in wages and salaries paid in different companies. It is impossible to meet on an even or near even basis the costs of production under the radically lower labor costs." Japanese labor is paid one-tenth and European one-fourth to one-third of American labor, he said. On this basis he estimated the cost of porcelain insulator in the U. S. at $1.10, in Japan at 48.84¢, and in Europe at 62.70¢.

Harvey pointed out that electric light and power resources of this country are so vital to the health, welfare, and safety of the nation, both in peace and war that every reasonable precaution should be taken to protect them. Outdoor transformer and switching stations are inherently vulnerable to damage by tornadoes, earthquakes, explosions, saboteurs, strategic bombing and direct gunfire, he said. And loss of any such vital installation may result in loss of electrical service to important industrial and urban areas.

"We have shown that our industry has already suffered due to the present tariff law and the actions taken under the Buy American Act. Therefore, it is obvious that any further concession under HR 1 would be disastrous to our highly essential industry."

Ever Wonder:

What your customers think about their light bills?

How changes in operating procedures affect customers?

Whether field collections work best for delinquent customers?

To Find Out,

Union Electric Advice Is . . .

Maintain Continuing Customer Attitude Survey

JOHN C. FARIS, Manager, Customer Business Department, Union Electric Co of Missouri, St. Louis

In order that top management may make the wisest decisions and choose the best course in matters that affect customer relations, the Union Electric Co maintains a continuing survey of customer attitudes. In the past eight years more than 100,000 customers have been interviewed, 25% of all of the company's customers. Results have more than justified the effort and expense.

There are several different methods of determining customer attitudes. Surveys may be made either continuously or intermittently. They may be conducted by outside specialists or by the utility's own personnel, specifically trained for the purpose. Surveys may be conducted by telephone, mail, or personal interviews.

To be worth anything, an attitude survey must determine the opinion of a true cross-section of all customers. This involves going to the customer and asking him what he thinks or feels, about the company, its policies, personnel, or procedures.

Union Electric serves more than half a million electric customers in Missouri, Illinois, and Iowa. Throughout World War II when goods were in short supply and many people got "pushed around," the company developed a comprehensive program to improve customer relations, with numerous avenues of approach and varied media. By the end of the war Pres. J. Wesley McAfee decided that it was time to find out where the company stood with its customers, to uncover any weak spots in operations affecting them, and to take corrective measures wherever possible.

After several months of study and investigation of survey techniques, Union Electric began its own continuous customer attitude survey on April 1, 1946, with its own trained personnel. Besides the value of specific disclosures and trend data, various by-products alone have proved the worth of the survey many times over.

Double-Barreled Approach . . . Besides the cost there are other important differences between attitude surveys conducted by company personnel and those made by outside concerns. A list of specific questions may be used

in either case, providing for checking off "Yes," "No," or "Don't know answers. Such an interview can be conducted quickly by interviewers with a minimum of training. This method suffices for opinion surveys on relatively simple matters but ordinarily does not provide for what is known as a survey "in depth."

What Union Electric wanted to do was to go behind these quick answers by customers to get at their real thoughts. Therefore, a series of conversational questions are asked to stimulate the customer into saying anything that comes into his mind about the company, its personnel, policies, service, rates, or anything else. It was found that most people do not hesitate to speak freely once the conversational gate is open. The interviewers then record, as nearly verbatim as possible, exactly what the customer says. Their reports are subsequently analyzed and tabulated by office specialists.

The second phase of this survey operation can only be accomplished by company personnel. All the interviewers are experienced in customer service work. They assist in the office, relieve on peaks every Monday, and during vacation periods, answer every type of inquiry received from customers either by telephone or in person. They are familiar with all billing and meter reading operations, credit and collection procedures, meter testing, and so on. They have a general knowledge of most company policies and procedures affecting customers. They are familiar with rate schedules.

During their informal chats with customers at their homes, many questions are raised by people who think their bills are too high, who have some service complaint, who do not understand credit requirements, or who want to know about merchandising activities or whether we repair appliances. Most misunderstandings are cleared up by interviewers on the spot. Occasional cases cannot be completed at the time of the interview, such as more serious high bill complaints, requests for tree trimming, and changing meter locations. The interviewer notes these, and they are referred to the appropriate department.

In this type of company-operated research survey the company has a double-barrelled function. It believes that the attitude measurements produced are valid and the statistical results provide meaningful trends. The benefits attained from the second phase of the work, while difficult to evaluate in dollars, are undoubtedly reflected in improved customer relations. Interviewers become ambassadors of good will. This latter activity could not very well be carried on by employees of an outside concern.

Planning Survey Routes . . . Survey routes are planned to reach a true cross section of customers each year, by census tracts and income levels. Periodically the operation is reviewed, but it is essential to follow closely the original structure so that results may be compared from year to year.

Interviewers do not go from door-to-door. After talking to one housewife, they will call on someone three or four doors away or across the street. The objective is to spread their good will efforts into ever widening circles, because the impression made in one household is frequently discussed between next-door neighbors.

Trend Data Obtained . . . With the information obtained from surveys general customer attitudes from year to year can be compared. These are classified under the headings "Favorable," "Doubtful," and "Unfavorable."

It has been established that there was a continual improvement in the company's standing among its residential customers each year until a rate increase which became effective on Sept. 28, 1953. During the following winter, the effect of the rate increase superimposed upon seasonally higher bills resulted in many more comments and to a lesser extent complaints about the size of bills. This was expected.

If a good job has been done in presenting the case to the public, however, that situation should be temporary. Hence, the next survey should show a leveling off. Such trend data is important, particularly for the guidance of the Public Relations and Advertising Department in program planning.

Spot Survey Results . . . Interviewers have also been used in determining customer opinion in specific instances. In nearly every case these special reports have been useful to management in deciding on matters of policy.

In the company's territory customers had been served at 25 cycles since the Keokuk Dam was built on the Mississippi River 40 years ago. After changing the power supply to 60 cycles, the company undertook to change all the motors in customers' homes from 25 to 60 cycles. It was reported by local officials that a sizeable proportion of people were not pleased at the way some of their appliances were operating after being converted; so interviewers were sent into the area for a week.

As a result some expert electricians were assigned to make follow-up calls on every customer about 60 days after the change to make sure that appliances were operating satisfactorily. This cleared up an undesirable situation which might have gone on indefinitely. It costs money to rectify some of these situations, but there is no short cut if you want to improve or maintain good customer relations.

Another spot survey was conducted a few years ago when field collections of delinquent accounts were abandoned. This was a radical departure from the long-standing practice of most utility companies. Some said it would never work, that it was risking serious damage to customer relations.

However, one division had never used field collections. Interviewers went into this area and called on customers who had been disconnected for non-payment of delinquent bills even though they had the money at the time of the field call. It was found that these people made excuses as to why the bill had not been paid, but none blamed the company for the action taken. Some of them objected to having to make a trip to a company office to pay the bill in order to get service restored, but there was no real adverse feeling.

Eventually the practice was extended throughout the entire system. After a year there were only a handful of complaints to the office and none to any regulatory commissions.

Other Survey Methods . . . There are various methods of determining customer attitudes, but none is so accurate as personal interviews. Surveys by mail may be used for certain specific purposes, with fairly good results. If you should choose to check whether service calls in response to customers' requests have been handled promptly, ef-

ficiently, and courteously, two-way post cards that are easy and convenient for the customer to fill out and return may be used.

Mail samplings of general attitudes are less satisfactory. Returns are likely to be low, from 15 to possibily 45%. While some criterion for action might be suggested by such partial returns, extreme caution is necessary. This stems from the basic fact that the validity of any survey depends primarily upon the accuracy of the cross section of replies. Some people will talk freely in a personal interview but won't take time to write anything, even on a return post card. A certain proportion of people habitually throw away such mail without even reading it. With these imponderables it is difficult to say that a mail survey, at least on general topics, is indicative of the true attitude of an entire section of population.

One advantage of a mail survey is that it is inexpensive when compared to personal interviews. The same is true of telephone surveys. However, the telephone may be used for certain purposes, as Union Electric and other companies have done for one-shot projects.

A general attitude survey by telephone is unsatisfactory. While residential telephone installations have expanded tremendously since the war, few cities have more than 80% saturation. If every one of those 80% of our people were contacted, it would still not develop what the other 20% think; yet those customers use electric service as do the 80% who have telephones.

Telephone conversations are apt to be much more guarded. People will speak less freely than they would to a personal interviewer. Thus the dependability of general attitude surveys by telephone is very doubtful.

General Objective . . . These alternatives are suggested only for consideration for company-conducted surveys as compared with surveys by outside concerns. If a utility wants to find out what its customers think about the company, plans must be made accordingly.

We do not permit interviewers to solicit any sort of sales leads. They do not hand out any material that smacks of promotional activities. Leaflets are given to customers only in response to a specific comment or request. They only include small brochures on how to replace fuses, how to read meters, why bills vary between seasons, and so on. Nothing is done or said to create suspicion that we are calling for any purpose other than to discuss the customer's service and to be helpful in answering any questions he may have in mind.

Realizing that the answers from 1,000 people who represent a true cross section should be as accurate within 3 or 4% as if a million people are interviewed, Union Electric deliberately planned its own survey on a continuing basis. With its two-fold approach, the statistical data have become more or less a by-product. The very fact that a utility company thinks enough of its customers to send a representative to their homes for an informal conversational chat, but with nothing to sell, makes a pleasing impression on most people.

4 Utilities Nominated for Coffin Award for '54

Four electric companies have been nominated for the Charles A. Coffin Award for 1954. The companies have been asked to submit presentations for the final award, which will be made at the annual Edison Electric Institute convention in June at San Francisco.

The four utilities, selected from a list of 28 candidates, are Arizona Public Service Co, Cleveland Electric Illuminating Co, Pennsylvania Power & Light Co, and Texas Power & Light Co. All will receive certificates of citation. Coffin Award for which they will compete consists of a gold medal and $1,000 for the company's employee benefit fund. It is presented in recognition of outstanding achievements.

Coffin Award Review Committee gave these reasons for selection of the four companies:

Arizona Public Service—for successful community approach to job of spreading ideals of American democracy and for new concept of cooperative sales promotion and load building.

Cleveland Electric Illuminating—for successful development of organization teamwork techniques.

Pennsylvania P&L—for contributions to all phases of sales promotion and business development in 1954.

Texas P&L—for extraordinary contributions to industrial and agricultural development through research in use of untapped natural resources.

TVA Personnel Cuts Accompany Fund Slash

Tennessee Valley Authority has announced a breakdown on the contemplated dismissal of one-fourth of its personnel as a result of President Eisenhower's proposal to slash the agency's appropriations about 75%.

The contemplated breakdown calls for a total reduction of 5,389 TVA employees for the 1956 fiscal year. Of that amount, 4,584 would be hourly employees in construction activities and 805 annual employees in supervisory and office work.

TVA, as of June of this year, will have an estimated 20,705 employees. The reduced budget contemplates about 15,316 employees at the end of the fiscal year of 1956.

New Officers, Directors Are Nominated by AIEE

American Institute of Electrical Engineers has announced the nomination of the following association officials: Vice president, Cullen T. Pearce, Westinghouse Electric Corp, Philadelphia; William J. Miller, University of Alabama; Evan R. Jones, Mountain States Telephone & Telegraph Co, Denver, Colo.; Bradley Cozzens, Los Angeles Water & Power Department; and Bristow G. Ballard, National Research Council of Canada, Ottawa.

Directors nominated were Julian D. Tebo, Bell Telephone Laboratories, Inc, New York; Paul G. Wallace, Texas Power & Light Co, Dallas, Tex.; and John C. Woods, Commonwealth Edison Co, Chicago. Walter J. Barrett, New Jersey Bell Telephone Co, Newark, was renominated as treasurer for one year.

AIEE had announced earlier that M. D. Hooven of Public Service Electric & Gas Co, Newark, N. J., was nominated as its 1955-56 president (EW, Feb. 7, p 55).

Balloting for officers for balance of slate will be by mail and results will be revealed at the AIEE Summer General Meeting.

"Hold it, Joe... this one doesn't need painting... it's a POLE STAR"

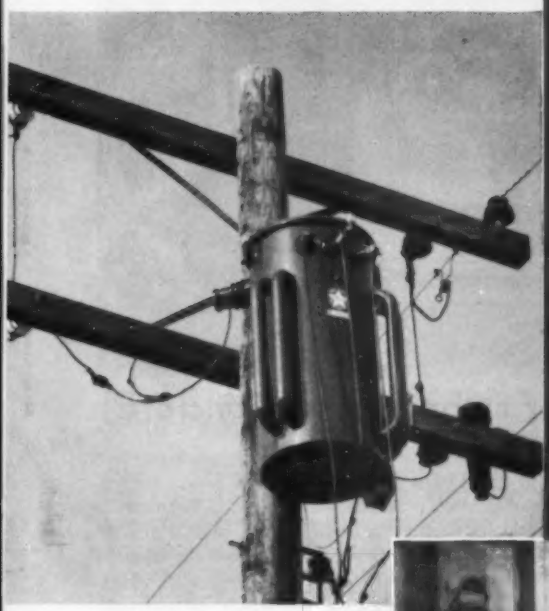
You can put that replacement back in the truck, Joe. You should know that Pennsylvania Transformer Company takes exceptional care to properly prepare Pole Star tanks for painting and to apply and bake on a tough, abrasion-resistant, weather-resistant, oil-proof paint.

Tanks of heavy gauge steel are shot-blasted with fine steel grit to free the tanks of all scale and rust. Shot-blasting, and only shot-blasting, can do a thorough cleaning job on metal.

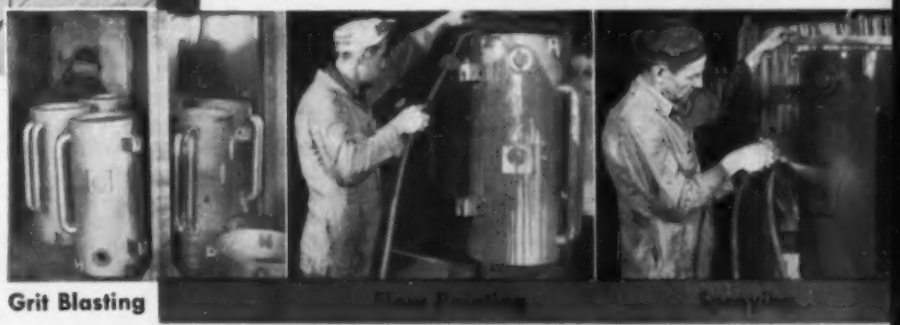
After cleaning, tanks are immediately covered — by the flow-coating method — with a red primer coat of paint. When the base coat is thoroughly baked dry, a coat of blue-gray transformer paint is flowed on and it, too, is oven-dried.

Finally, a third coat of paint is sprayed on to add to the film thickness and to provide a smooth finish with a maximum amount of gloss.

Thus, by using a superior time-tested paint and by paying special attention to cleaning and painting, Pennsylvania gives each Pole Star tank the maximum amount of protection for the longest possible time.



Pole Star transformers are available in sizes 3 Kva through 500 Kva and in voltages from 480 through 67,000 volts. Protected Pole Star transformers are available up through 100 Kva and are equipped with safety devices for maximum protection.



Grit Blasting

pt POLE STAR

Pennsylvania Transformer Company

A McGraw Electric Company Division

CANONSBURG • PENNSYLVANIA

Atomic Panel . . .

. . . session set for American Power Conference's meeting slated for March 30-April 1

The American Power Conference's 17th annual meeting will be devoted to atomic energy developments, industry research, electrical system planning, and industrial applications. The meeting, sponsored by the Illinois Institute of Technology, will be held March 30-April 1 at the Sherman Hotel in Chicago.

Key addresses at the parley's opening meeting will be delivered by John W. Evers, president of Commonwealth Edison Co and Howard P. Seelye, manager of engineering for Detroit Edison Co. Evers' talk is entitled "Where We Stand Today in the Electric Industry." Seelye will discuss "Research in the Utility Industry."

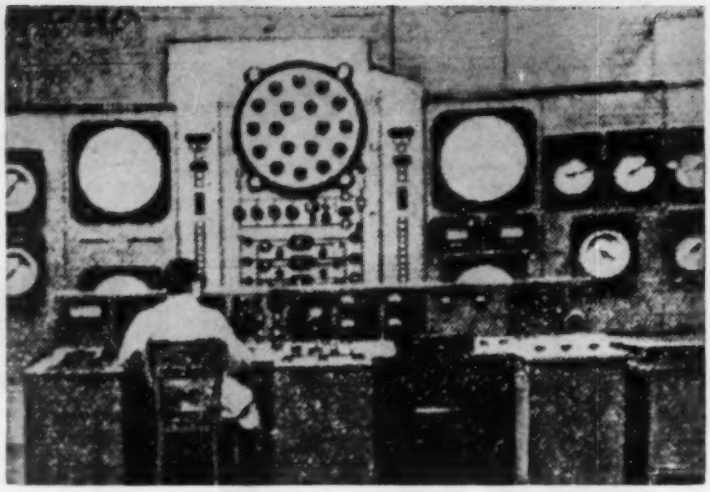
Atomic Energy Session . . . The panel session on development of atomic energy for power purposes will have as its chairman Titus LeClair of Commonwealth Edison Co. Sen Bourke B. Hickenlooper (R-Iowa), a member of the Joint Congressional Committee on Atomic Energy is slated to be panel moderator. Panel members will include Philip Sporn, president, American Gas & Electric Co, representing the Nuclear Power Group, and Walker L. Cisler, president, Detroit Edison, representing the Atomic Power Development Associates.

Research aspects of steam generators and steam turbines will also be explored at two sessions. Research in the field of steam generators will be analyzed and discussed by Leslie S. Wilcoxson, vice president of Babcock & Wilcox Co, and W. H. Armscost, vice president of Combustion Engineering, Inc.

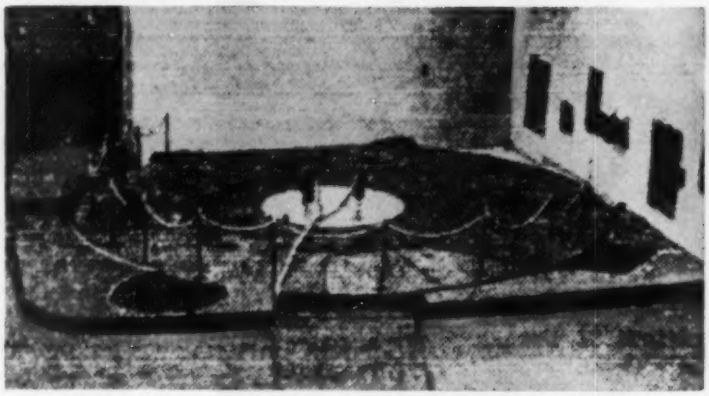
Advances in large steam turbine research and development will be reviewed by H. D. Emmert, assistant chief engineer of the steam turbine section of Allis-Chalmers Manufacturing Co. Research and development in the field of turbine generator prime movers in General Electric Co will be revealed by that firm's Vice Pres Glenn B. Warren.

Long Range Planning . . . "Overall Planning of Systems for the Long Range Future" is the topic scheduled to be discussed by H. L. Melvin, chief consulting engineer for Ebasco Services. His talk will be made at one of two sessions planned on electrical system planning. Regional coordination of power systems will be discussed by Federal Power Commission's F. L. Adams.

Impact of air conditioning on the electric utility industry will be analyzed by Fischer Black, editor and publisher of Electrical World. His talk will be delivered at the meeting's industrial applications session.



Soviet's First Atomic Power Station . . .



. . . Has Reactor Embedded in Concrete

The Soviet Communist Party newspaper Pravda has printed these two pictures of what is reported to be Russia's first atomic energy power station. The top picture was called the control panel of plant showing engineer in charge. The bottom photo was called the roped-off top of atomic reactor which is embedded in concrete. The Russians have not disclosed the location of the plant.

Water Report Available

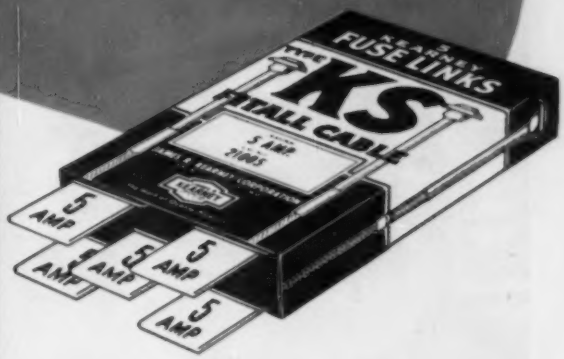
● Publication of Volume 109 of the Water Resources Papers, Surface Water Supply of Canada has been announced by the Water Resources Division of Canada's Department of Northern Affairs and National Resources. The report may be obtained from the Chief of the Water Resources Division in Ottawa 4, Ont. The publication is available at a price of $3.00 a copy.

Each Outage is one too many!

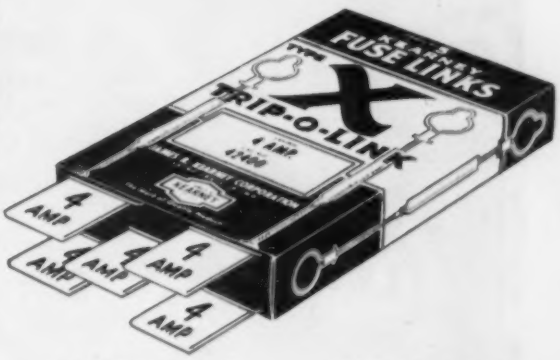
These closely co-ordinated KEARNEY FUSE LINKS prevent unnecessary blowing

For a smooth functioning, customer pleasing system, you may need more than just "fast" and "slow" fuse links. These Kearney *Specialized* links have precision matched time-current characteristics to prevent unnecessary interruptions . . . and, at the same time, protect your equipment.

ALL KEARNEY FUSE LINKS . . . including EEI-NEMA Standard Types . . . are color-coded to save time and prevent mistakes. They are packaged for easy handling and engineered with the accuracy you need for effective co-ordination. Time-current curves are available to help you work out your coordination.



KEARNEY Type KS . . . specially designed to protect and still keep outages at a minimum on circuits subject to switching and lightning surges.



KEARNEY Type X . . . specially designed to keep transformers in service during overloads and surges . . . yet to protect before the damage range is reached. Opens 230% of rated current load within five minutes.

276

For Better Construction . . . Safer Maintenance

Specify **KEARNEY** PRODUCTS

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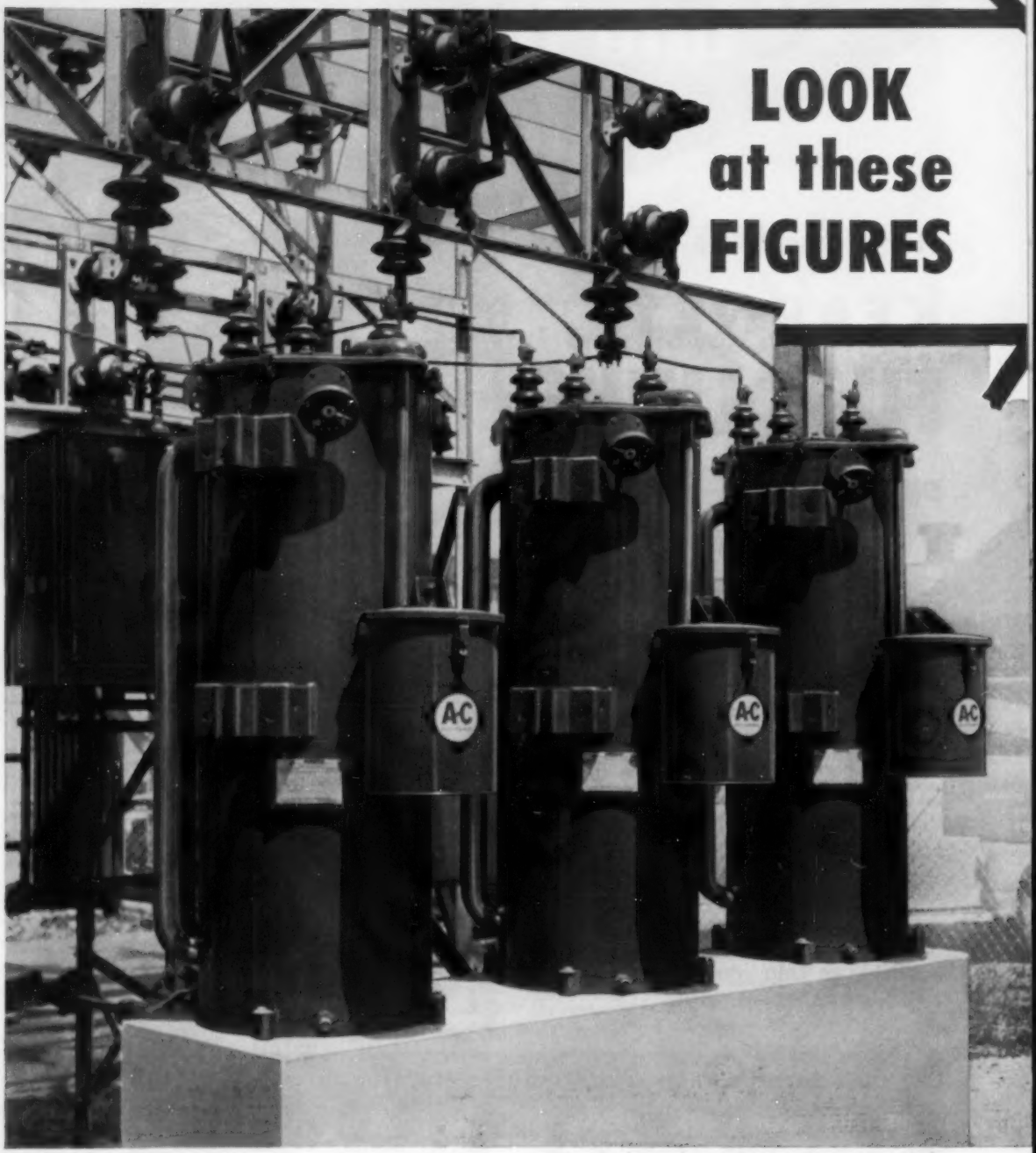
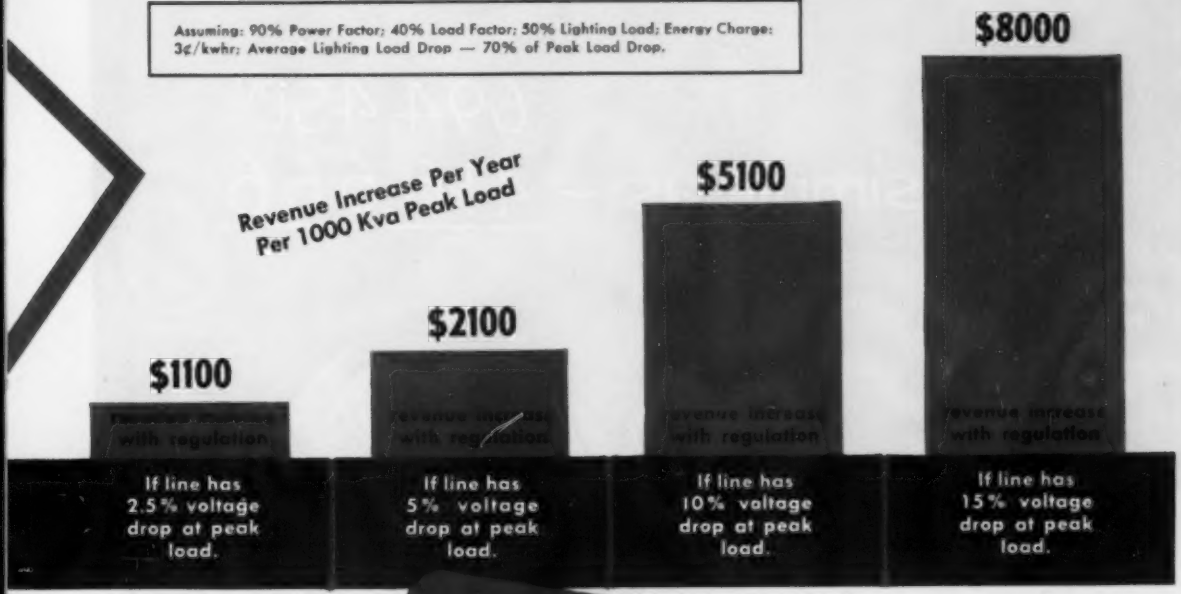
How Voltage



ALLIS-

Regulation Pays Off

Assuming: 90% Power Factor; 40% Load Factor; 50% Lighting Load; Energy Charge: 3¢/kwhr; Average Lighting Load Drop — 70% of Peak Load Drop.


Revenue Increase Per Year Per 1000 Kva Peak Load
$1100
$2100
$5100
$8000
If line has 2.5% voltage drop at peak load.
If line has 5% voltage drop at peak load.
If line has 10% voltage drop at peak load.
If line has 15% voltage drop at peak load.

ALLIS-CHALMERS 5/8% STEP VOLTAGE REGULATORS

• Here's what happens when you install an Allis-Chalmers distribution regulator on a line where voltage is only 5% low: in the first year revenue per regulator goes up $2100. That's more than the regulator costs. And taking all cost factors into consideration — that's enough to pay back the initial investment in less than two years, in most cases. From then on (long before the end of your normal depreciation period), the distribution regulator helps you make additional profits.

Best of all, at the same time you improve revenue you also improve customer satisfaction. With correct voltage, motors last longer, lights burn brighter, appliances give most efficient service. You get an added dividend: fewer complaints due to low voltage. You can concentrate service crews and equipment where they are really needed instead of wasting manpower and money testing voltage at customers' homes.

Keep Maintenance Low, Get Long Life

When you specify Allis-Chalmers voltage regulators you know you're getting a unit with minimum maintenance, longest possible life. No other ⅝% step regulator offers proof from years of actual field experience. Allis-Chalmers step-type regulators have been turning in excellent service records for more than 20 years.

For example, the mechanism is tested and proved to withstand 5 million operations. It will provide practically trouble-free operation. Ask any of the hundreds of distribution engineers who have had experience with it. They'll tell you why it pays to use only Allis-Chalmers voltage regulators.

More facts are available. Get them from your nearby A-C district office or write Allis-Chalmers, Milwaukee 1, Wis. A-4562

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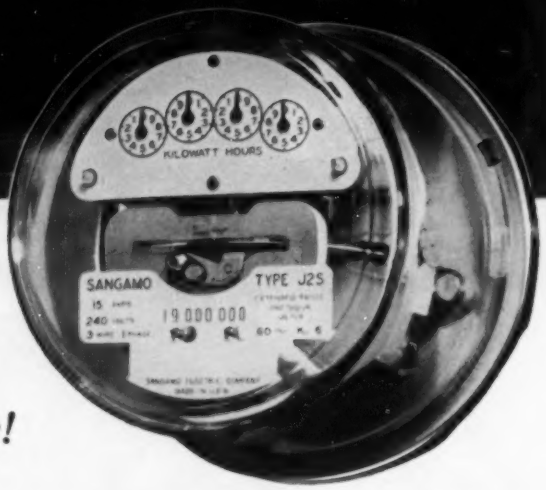
the J2 Meter is the SLOW SPEED METER

694,450
it's as simple as – 416,666



the J2 makes fewer revolutions *and fewer revolutions mean less wear . . . longer service life!*

The J2 Watthour Meter is the *slow speed meter*. It makes fewer revolutions than other meters—including the J2's predecessor, the Sangamo Type J—to measure the same load.

Fewer revolutions mean less wear on all moving parts . . . and *less wear means longer service life.*

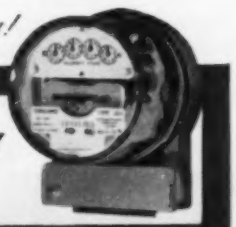
Here's what this means in terms of only one year's time. The J2 has a 6.0 constant. It makes 166⅔ revolutions to measure one kilowatthour. The J Meter had a 3.6 constant. It made 277.7 revolutions to measure one kilowatthour.

Today's average residential load is 2500 kilowatthours. If you multiply this figure by 277.7, you get 694,450—the number of revolutions a 3.6 constant meter must make in order to measure 2500 kilowatthours.

Let's multiply 2500 kilowatthours by 166⅔, the speed of the J2 Meter. Here we get 416,666 revolutions per average load per year. And the difference between 690,450 and 416,666 is 277,784. In other words, the J2 makes 277,784 *fewer* revolutions in a year to measure the *same* load.

While the total fewer revolutions the J2 makes in only a year's time is impressive, think what it would add up to by 1985! Doesn't it stand to reason that there will be less wear on the moving parts of the J2? And with less wear on moving parts, it just naturally follows that the J2 will give many more years of trouble-free service.

the FIRST watthour meter with straight line accuracy up to 100 amperes!



SANGAMO ELECTRIC COMPANY

SPRINGFIELD, ILLINOIS

JM55-2

As Standard Utilization Voltage . . .

240/416-V System Offers Economy

A. J. PANSINI, Manager Line Construction and Maintenance,* Long Island Lighting Co, Hicksville, N. Y.

The Long Island Lighting Co, a predominantly residential system, believes 240/416 v should be the preferred standard voltage when higher utilization voltages are used. Reasons for this opinion are as follows:

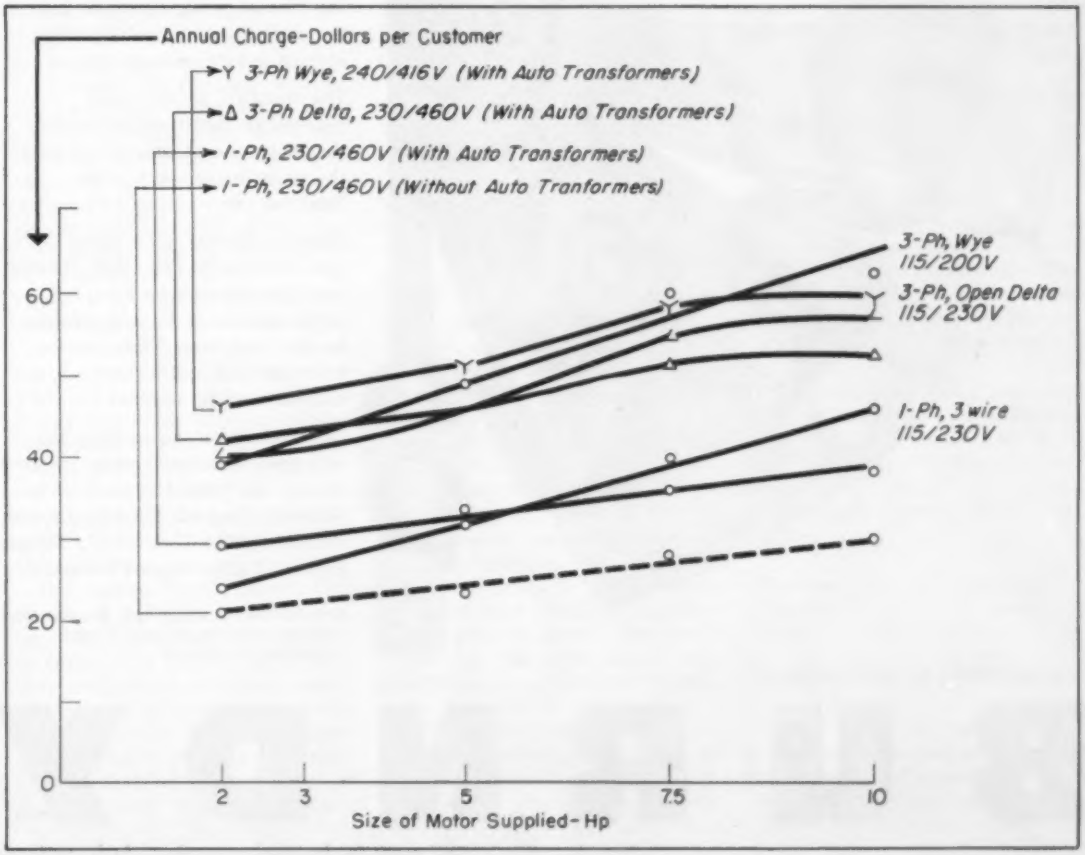
- It is more desirable, from both economic and customer relations viewpoints, to raise residential service voltage levels rather than resort to more costly three-phase service as means of supplying large residential loads. In using 240/416 systems the customer would be served with 240 v single phase unless his load required three-phase service. Then he would receive 240/416-v three-phase service.
- Single-phase appliances are now manufactured for 240-v operation.
- Enormous investments in 240-v, single-phase, equipment, both on the part of the customer and the utility can be reused for either 240/416 v three phase, or 240/480 v single phase application.
- Perhaps as much as 60% of electric customers outside of the United States receive service at the 240/416-v (or approximate) level and none at the 277/480-v level. Here is a possibility to establish a world standard for utilization voltage.

Studies by Long Island Lighting in 1952, and others, have indicated single phase to be more economical than three phase for residential service.

The accompanying graph shows estimated annual charges for various systems designed to supply a typical development consisting of 64 residences having lighting, refrigeration, oil burners, and miscellaneous appliances. One hundred per cent saturation of air conditioning equipment is assumed. The annual charge per customer is plotted as a function of the largest motor. The graph shows that the higher voltage system requiring no transformation to supply 120-v appliances is the least costly. Cost of providing voltage transformation reduces the savings somewhat, but the

(*Continued on page* 27)

*Formerly Manager, Meters and Distribution Engineering



ten million jerks a year...

can't shake these connections loose

The problem was simple—but the solution was ingenious.

To dry and sift clay in a single operation, a major Southern brick manufacturing company conceived the idea of passing current through the sifting screen itself—making it a giant resistance-heated sieve.

The electrical problem was connections that could withstand the 70 jerks each minute between the vibrating screen and the fixed bus bar.

Solution: Sturdy VVA clamp connectors providing tight, reliable, re-usable connections carrying 2,500 amperes at 45 volts between bus bar and strap. Their service record on this job: 5 years without a single failure!

Better electrical connections can help speed your production, improve quality, cut costs. Call on Burndy—Norwalk, Connect., Toronto, Canada. *Factories:* New York, Calif., Toronto. *Export:* Philips Export Company.

BURNDY VVA: V-BOLT TYPE, ENGINEERED TO HOLD TIGHT UNDER CONTINUOUS VIBRATION. RE-USABLE.

It's good business to connect with...

BURNDY

54-22

...FIRST name in electrical connectors; tools; methods

240/416-V System Saves

(*Continued from page 25*)

higher voltage system is still more economical than other systems when motors of 5 hp or greater are used.

An important cost factor for conventional service voltage is the limitation on transformer secondary design imposed by motor starting. Higher secondary voltage solves this problem because inrush current is reduced to half and percentage voltage drop in supply conductors to one fourth when the operating voltage is doubled. This problem will become more important as the use of residential air conditioners and heat pumps increases.

Another advantage of single-phase construction is that pressure for underground service is more likely to build up when the relatively obtrusive three-phase construction is employed. Three-phase lines with transformer banks of two or three units, especially in rear lot constructed lines, cause consumer objection. A greater problem is difficulty in obtaining a right-of-way or easement for 8-ft crossarm with 8-ft clearance on either side required by present code specifications for 13.2-kv construction.

Where three-phase service is used to supply residences, voltage unbalance problems are likely to occur. Residential loads will continue to be predominatly single phase which cannot be balanced properly on the three-phase feeder. Serious difficulty in motor operation can occur with voltage unbalance of only 2 or 3%.

Three-phase systems, whether at the present voltage level or at the higher voltage, are found to be more costly than any single-phase system considered. However the approximately double voltage three-phase systems compares favorably with the present three-phase systems even with added transformers for supplying appliances at the 120-v level. And they will permit the use of the less expensive 2-wire 240-v service to many residences where 3-wire 240/480-v service is not needed.

The customer would also save with the use of a higher secondary voltage. One half as much copper would be required for interior wiring for a given load, or the capacity of existing wiring could be doubled. This may be an economical solution to inadequate wiring in existing residences. Current carrying requirements of switching and control equipment would be halved and this should reduce cost of those elements to the customer, even though voltage levels are doubled.

Use Existing Appliances . . . Many 240-v appliances presently manufactured in this country for the export market could be used domestically. Some fractional-horsepower motors now operated at 120 v can be reconnected for 240-v operation. Today's 120-v household appliances will have reached the end of their useful life in 10 to 15 yrs; before the end of this period the existence of a substantial number of higher voltage systems will increase the demand, and therefore the supply, for appliances in the higher voltage class. But where transformation is required for 120-v appliances, the 240-v source could make use of present day transformers, whereas the 277-v source means a new line of transformers.

Some artificial restrictions against the use of higher voltages have been removed by the liberalization of the National Board of Underwriters' voltage-to-ground requirements. It is now permissible to have 300-v lighting circuit conductors if they supply lighting fixtures placed at least 8 ft above floor level, and where such fixtures do not include switches. A wall switch has been developed and approved by the Underwriters for use with this class of lighting.

Use Present Investment . . . The 277/480-v system makes no provision for customer and utility equipment designed for 220, 230, or 208-v operation. Equipment in these categories, including motor controls, switches, etc, represent a sizable portion of today's total investment in residential, commercial, and industrial installations. The cost of converting large systems using this equipment to 277/480 v would be prohibitive in most cases. So far as the utilities are concerned, 227/480 v means a new line of distribution transformers, meters, and other apparatus.

The desirability of using existing equipment when changing to a higher voltage level has already been established with changes in primary distribution voltages. Thus 2,400-v equipment need not be discarded if a 4,160Y system is established. If use of existing equipment were not a determinating factor, there is no apparent reason why 5,500 or 6,000 v should not have been selected for higher voltage primaries.

The proposed use of 277/480 v avoids the 120-v appliance problem entirely simply by restricting the application of this system to installations where the 120-v loads are nonexistent or sufficiently small to be handled by small capacity load centers without prohibitive cost. On the other hand, a system having a 240-v source available would at least allow operation of dual voltage rated equipment directly. Thus, in buildings having 120/240-v room air conditioners, no special load center would be necessary.

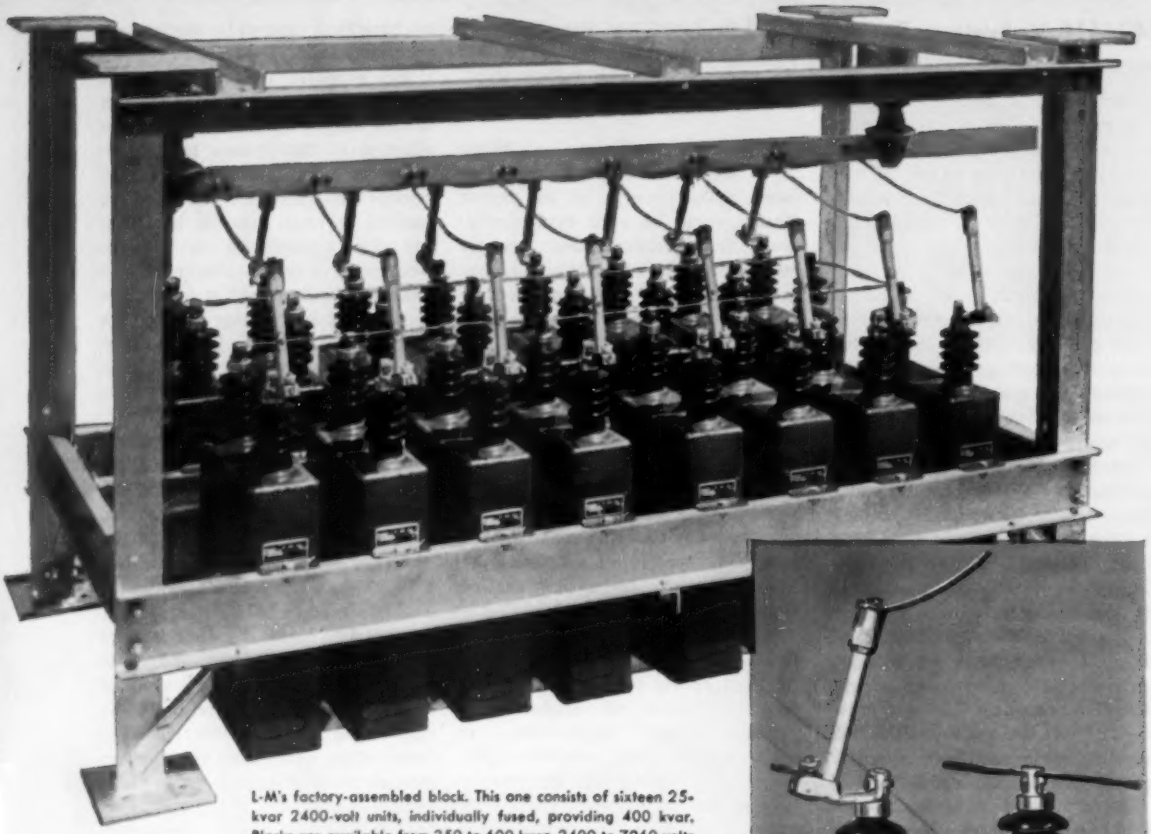
An EEI-NEMA report (Preferred Voltage Ratings for AC Systems and Equipment, EEI No. R6, NEMA No. 117) indicates 440 v as the common rating for motors in the 400-v class. The 440-v value is approximately 5.5% higher than the 416-v source available from a 240/416-v system, about 4.5% below the 460-v service of the 265/460-v system, and about 9.1% below the 480-v service of the 277/480-v system. Therefore 440-v rated motors will operate closer to rated voltage on the 240/416-v system than on the other systems. Also under conditions of underloading, which may exist to a greater degree than is generally suspected, induction motors will operate with better power factor and efficiency at voltages below the rated value.

If a new service voltage is established before the development of appliances, difficulties; similar to those encountered when 208-v networks were used to serve existing 220-v motors can be avoided. New developments would fall in line with the new facilities proposed to serve them.

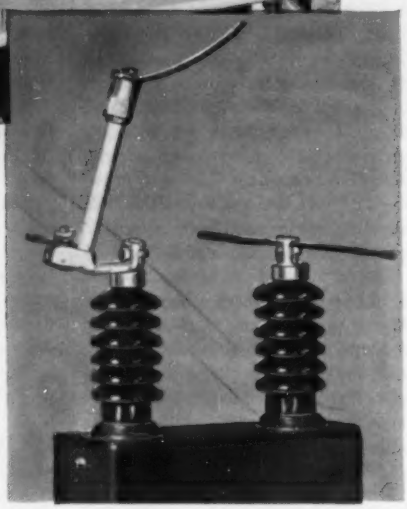
A transformer having two 5% taps above 240-v to boost the secondary output as high as 464 v may be used to handle critical cases. This would make the 240/416-v system somewhat compatible with any 277/480-v equipment or system existing in insolated installations.

World Standard . . . A study of the utilization voltages in use throughout the world, excluding this country, does not reveal any instances where 277 v is in use; but voltages in the neighborhood of 110, 115, 120 and integral multiples thereof are common. The 277-v base would therefore introduce another value for consideration.

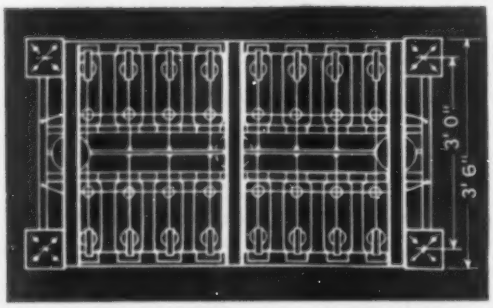
(*Continued on page 39*)

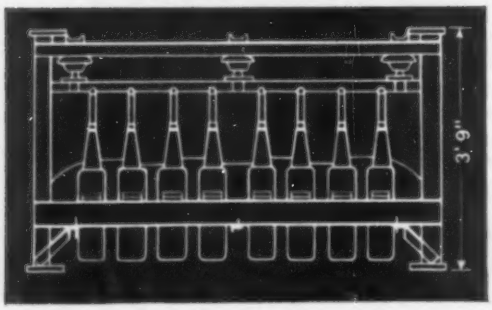


L-M's factory-assembled block. This one consists of sixteen 25-kvar 2400-volt units, individually fused, providing 400 kvar. Blocks are available from 250 to 600 kvar, 2400 to 7960 volts —all NEMA-standard sizes. Note that top and bottom plates are drilled for bolting to base support or spacing insulators or to plates of adjacent blocks. Steel frame members are hot-dip galvanized for corrosion resistance and are jig assembled to insure perfect alignment of mounting plates.



Individual expulsion fuse, mounted on the bushing of each capacitor. Uses standard distribution fuse links. These fuses isolate any capacitor that fails before the tank can rupture and damage adjacent equipment. The bank can continue operating until the failed unit is replaced.



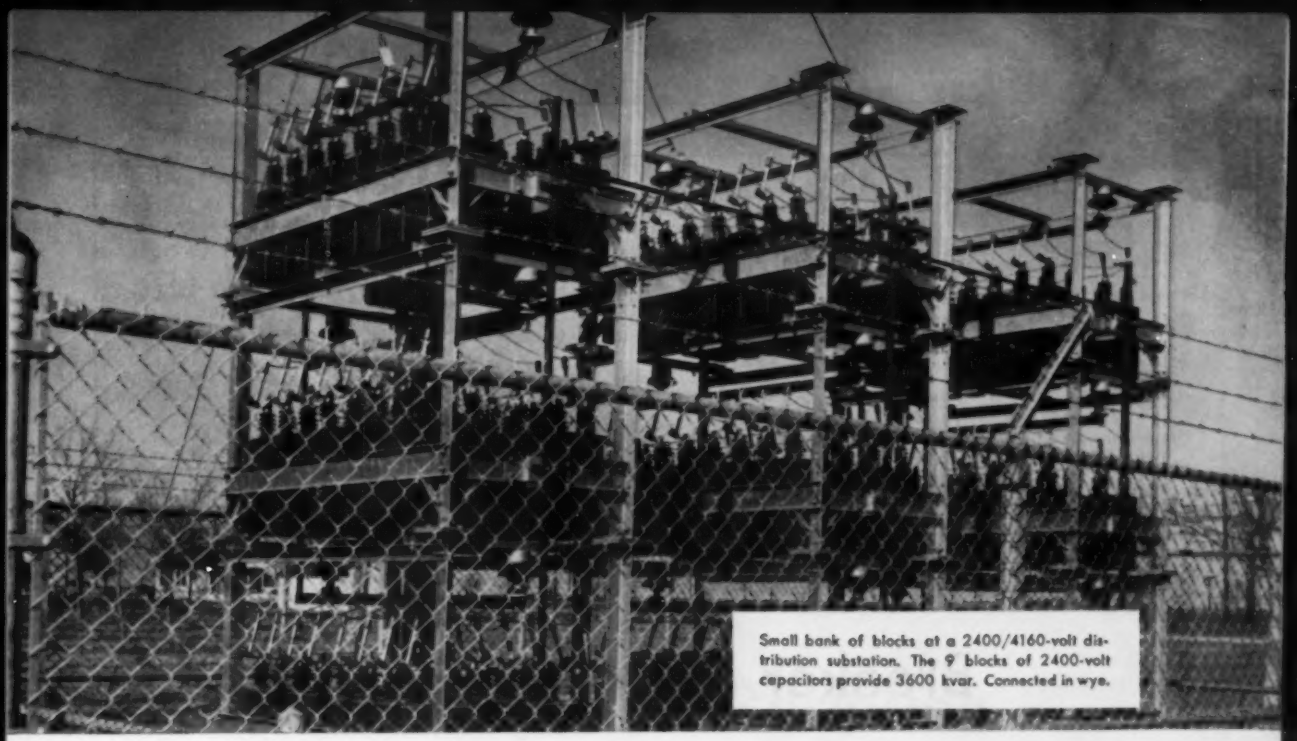


Drawings show arrangement of single-bushing Elemex capacitors in a 400-kvar 7200-volt block.

L-M Factory-Assembled Blocks Are Available in All NEMA-Standard Sizes

Voltage	KVAR	Number of Individual Capacitors Per Block	Rack Dimensions Center to Center of Mounting Plates Length	Width	Height
All sizes available from 2400 to 7960 volts	250	10	3'9½"	All	All
	300	12	4'5"	3'0"	3'9"
	350	14	5'1½"	(total outside width 3'6")	
	400	16	5'8"		
	450	18	6'3½"		
	500	20	6'11"		
	550	22	7'6½"		
	600	24	8'2"		

Mounting Plates
4 ¼"-dia. holes on 5" B.C. in top and bottom plates



Small bank of blocks at a 2400/4160-volt distribution substation. The 9 blocks of 2400-volt capacitors provide 3600 kvar. Connected in wye.

L-M Factory-Assembled Blocks Speed Capacitor Bank Installation

Factory-assembled, wired and fused blocks cut erection costs and time on large or small transmission or distribution capacitor banks.

By N. K. DELANEY
Manager of Capacitor Sales
Line Material Company

With the growing trend toward the application of capacitors to transmission lines, the cost of installation becomes a matter of growing concern. Large series-multiple banks can involve hundreds of individual capacitors. Wiring such units and the individual fuses takes many scarce man-hours.

L-M factory-assembled blocks cost only slightly more than the individual, unwired components. They not only cut installation time about one-half, but also save countless hours of engineering and installation supervision.

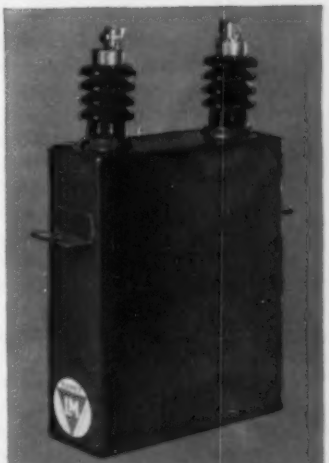
These blocks are built up in stacks, with or without spacing insulators as needed. The only wiring needed is the connections to each block, to obtain any desired series or parallel combination. The blocks themselves provide the steel needed for the capacitor structure. The great saving is obvious.

Another advantage of these L-M blocks is that they are easily moved and reinstalled at another location if conditions should make a change desirable. The rigid frame and sturdy construction make portability practical and safe.

L-M factory-assembled blocks are available with from ten to twenty-four 25-kvar capacitors, giving from 250 to 600 kvar per block, for voltages from 2400 to 7960. For higher voltages the blocks are connected in series. When transmission voltage banks are to be step switched, L-M's exclusive Voltage Divider Switching Method (patent applied for) provides an economical, efficient method for automatic switching.

Check The Costs—See What You Save

Ask the L-M Field Engineer to give you comparative costs of individual components and L-M blocks. You can readily arrive at the possible savings in time and manpower. Or write Line Material Company, Capacitor Sales, Milwaukee 1, Wisconsin (a McGraw Electric Company Division).



L-M's ELEMEX® Capacitors offer many desirable features—strong, solder-sealed bushings with "Para-groove" connectors; uniform terminal height above flanges in each voltage class; exclusive continuous-vacuum impregnation process assuring exceptionally low failure rate. Available with regular or low-temperature Elemex dielectric.

LINE MATERIAL *Elemex® Capacitors*

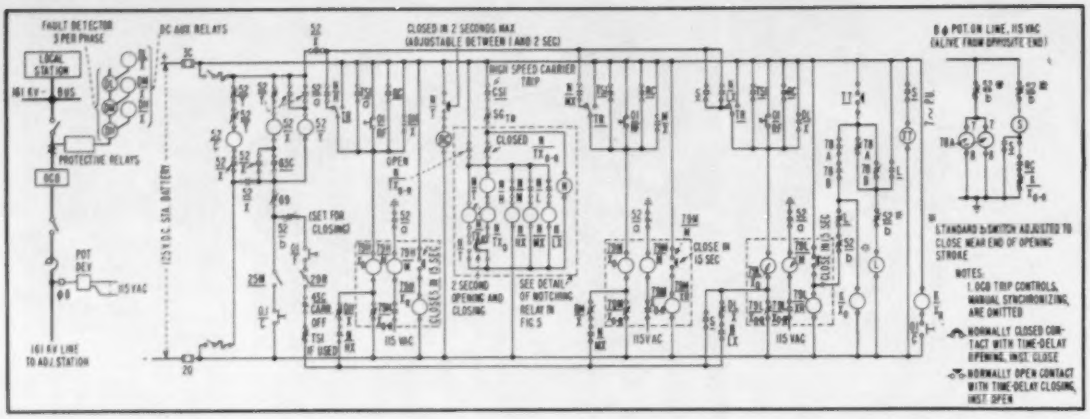

FAULT DETECTOR 3 PER PHASE
DC AUX RELAYS
CLOSED IN 2 SECONDS MAX (ADJUSTABLE BETWEEN 1 AND 2 SEC)
HIGH SPEED CARRIER TRIP
LOCAL STATION
161 KV BUS
PROTECTIVE RELAYS
OCO
POT DEV
115 VAC
125 V DC STA BATTERY
161 KV LINE TO ADJ STATION
(SET FOR CLOSING)
OPEN
CLOSED
2 SECOND OPENING AND CLOSING
SEE DETAIL OF NOTCHING RELAY IN FIG 5
CLOSE IN 15 SEC
115 VAC
115 VAC
115 VAC
STANDARD b-SWITCH ADJUSTED TO CLOSE NEAR END OF OPENING STROKE
NOTES:
1. OCO TRIP CONTROLS, MANUAL SYNCHRONIZING, ARE OMITTED
NORMALLY CLOSED CONTACT WITH TIME-DELAY OPENING, INST. CLOSE
NORMALLY OPEN CONTACT WITH TIME-DELAY CLOSING, INST. OPEN

FIG 1—MULTIPLE SELECTIVE RECLOSING of breakers may be used on lines from substations where 10,000-Mva fault level is reached with indicated sequence of operations. Appreciable benefits in form of improved service continuity at minimum cost will result from procedure

Breaker Performance Improved

V. J. CISSNA

G. F. SARGENT

R. M. FERRILL, Tennessee Valley Authority, Chattanooga, Tenn.

The major expense of replacing oil circuit breakers as a consequence of system growth confronts engineers today with acute problems in relaying and system economics.

Unless there is careful planning, breakers become inadequate, usually in short-circuit interrupting ability, and must be replaced or up-rated before a quarter of their usefulness is spent. The growing practice of fast reclosing for maximum transmission-line use involves derating of breakers which, in effect, accelerates their inadequacy.

While available breakers have 10,000-Mva interrupting capacity for 161-kv service and are capable of three successive fast reclosures, the combination of high capacity and fast reclosing is not present simultaneously. The 10,000-Mva capacity cannot be used without qualification for fast repetitive reclosing.

When breakers interrupt 10,000 Mva on a 15-sec, CO-cycle, they must be derated for reclosing service, and derating may be to as low as 5,100 Mva for three successive rapid reclosures. Such derating is necessary even though fault values of 10,000 Mva are not unusual with modern heavy transmission networks and interspersed generating stations with capacities up to a million kva.

Although most faults are far enough out on the line to keep fault values well below system maximum, they can be on lines very important in maintaining interchange and stability; so fast restoration may be both desirable and practicable. On the other hand, when the fault is on buses or close in on the lines, fast reclosure imposes too much duty on breakers, undue shock on the system, or both.

The problem resolves into selecting faults a breaker can handle satisfactorily. When a fault occurs, system engineers must determine whether fast reclosure is permissable and select the breaker for performing the desired operation. The diagram of station connections and sequence of operations in Fig. 1 indicates how this can be accomplished.

This method of selective reclosing permits reclosing as often as three times at 20 or 30-cycle intervals even though the breaker is placed where such reclosing is occasionally not permissible. It is a simple procedure for measuring the short circuit by current lockout relays in each phase and for determining relay settings. A fast synchronism check relay is used also.

Previous Methods . . . Conventional reclosing methods, previously in use on the Tennessee Valley Authority's system, provided for one fast reclosing keyed to the tripping of the breaker by pilot relaying. This was the best available means of assuring that both ends had tripped simultaneously. A fast reclosure, more or less simultaneous at each terminal, when unsuccessful was followed by a "dead-line" trial at one terminal of the line. The "dead-line" trial was controlled by a time-delay, under-voltage relay connected to a potential transformer on the line and interlocked with a voltage relay connected to the bus potential transformers.

The "dead-line" trial was ordinarily made in approximately 50 to 60 cycles after the line tripped out the first time. In most instances its timing was not affected by unsuccessful reclosure at 20 cycles. The breaker was opened after the unsuccessful reclosure at about 24 cycles after the first trip-out. It received a closing signal 30 cycles later, causing it to close in about 17 cycles, or in the order of 70 cycles after the first trip-out.

Devices and Symbols Used in Drawing at Left

01/C—OCB Manual Closing Switch—momentary closing
01/F—OCB Manual Float Switch—closes when 01/C is operated; stays closed until OCB Manual Trip is operated
01/RF—OCB Manual Float Switch—closes when OCB manual trip is operated stays closed until 01/C is operated
25M—Manual Synchronizing Switch
43C—Carrier-Off Switch
52/C—OCB Closing Coil
52/X—OCB Aux. Closing Relay
52/Y—OCB Aux. Relay—cuts out closing relay after OCB is closed
63C—OCB Low Air Pressure Switch—opens for low pressure
69—Reclose Cut-out Switch—opens on hand-trip, manual reset
79H—Reclosing Relay for 1st immediate reclosure
79M—Reclosing Relay for 2nd immediate reclosure
79L—Reclosing Relay for 3rd immediate reclosure
79H-M-L/M Motor-operated timer—operates to reset reclosing relay if OCB stays in for 15 sec
79H-M-L/X_{O-S} Toggle relay in reclosing relay—Contacts shown in reset position: Contacts reverse positions when X_O coil is energized, assume the reset position when X_S coil is next energized
78-A Phase Angle Measuring Relay—Connected to give torque reversal at 80 deg leading
78-B Phase Angle Measuring Relay—Connected to give torque reversal at 80 deg lagging
CS1—High Speed Carrier Relay Tripping Aux.—starter for notching relay
DH—Overcurrent Relay High Speed—1 per ph, set to pick-up if fault exceeds 8,400 M_{VA}
DM—Overcurrent Relay High Speed—1 per ph, set to pick-up if fault exceeds 6,400 M_{VA}
DL—Overcurrent Relay High Speed—1 per ph, set to pick-up if fault exceeds 5,100 M_{VA}
29R—Recloser cut-out switch
DH/X—D.C. Aux. Relay to *DH*
DM/X—D.C. Aux. Relay to *DM*
DL/X—D.C. Aux. Relay to *DL*
L—Lock-out Relay—prevents slow reclosing if synchronizing cannot be made
N—Notching Relay, 3 shot—energized by high speed carrier impulses
N/H—First Notch-up contact of *N*
N/M—Second Notch-up contact of *N*
N/L—Third Notch-up contact of *N*
} Close one at a time
N/HX—Aux Relay to *N*—sets up reclosing circuit for *79H*
N/MX—Aux Relay to *N*—sets up reclosing circuit for *79M*
N/LX—Aux Relay to *N*—sets up reclosing circuit for *79L*
RC—Recloser Cut-out Relay—cuts out reclosers after 3-shot timing cycle. Also cuts in fast synchronism check
S—Start Relay on fast synchronism check
SG_{TR}—Slow Speed Relay Tripping Aux
N/T—Timing Relay on *N*—Time adjustable between 1 and 2 seconds
TR—Slow Speed Reclosing Aux Relay
N/TX_{O-S}—Toggle Relay on *N*—contacts shown in reset pos.; contacts reverse positions when X_O coil is energized, assume reset pos. when X_S coil is next energized
T7—Timing Relay—picks up in 7 cycles to establish synchronism thru two 78 relays
TS-1—*W* Set-up Swing Block Reclosing Cut-out
K/X_{O-S}—Toggle Relay, same type as N/TX_{O-S}—blocks reclosing if OCB does not stay in after first synchronism check reclosure
52/a—OCB aux switch—closed when OCB is closed
52/b—OCB aux switch—closed when OCB is open

by Multiple Selective Reclosing

The other end of the line had the first reclosure in 20 cycles and tripped, followed by a synchronism check requiring 6 sec or longer for operation after line potential was restored. These times were considered to be quite slow when overall system stability was involved.

Selective Method . . . The present method permits lines to be reclosed much faster than is ordinarily practicable. It affords three successive 20-cycle reclosures, provided the reclosures are made on faults less than the derated breaker rating. Controls can be provided for switching by resorting to conventional breaker reclosing methods.

A high-speed synchronism check relay has replaced the slow-speed one. All reclosures, except that made by the synchronism check relay, are monitored by lockout fault detectors and the notching relay.

In setting relays to select faults under which the reclosers will operate, the curves in Fig 2 are followed. Curve (a) gives basic symmetrical values of short circuit current calculated by AIEE methods; curve (b) rms fault current just after two cycles, including the prescribed offset allowance; curve (c) pickup current for the lockout current relay; and, curve (d) rms values of the first loop for short circuits at different fault locations. Curves (a) and (c) are practically identical as "percent of pickup due to offset" counteracts the constant 1.2.

When three reclosures are to be set up, three sets of plunger relays are required on each breaker. Faults on 10,000-Mva breakers are not allowed to exceed 8,400 Mva for one high-speed reclosure, 6,400 Mva for two high-speed reclosures, and 5,100 Mva for three.

When all three relays of any phase pick up, all reclosing is blocked except by synchronism check relay. When a relay for 8,400 Mva does not pick up, one reclosure can be made. When the 8,400 and 6,400-Mva relays do not pick up, two reclosures can be made; and when none of the plunger lockout relays picks up, three reclosures can be made.

This action is based upon the assumption that faults are the same each time, which may not be true. The breaker may not be reclosed at the same point on the voltage wave, and different phases may be offset on succeeding reclosures. For this reason it may be possible to overstress a breaker although no special precautions are taken because of this. However, when no lockout fault detector picks up on the first reclosure and the 6,400-Mva detector picks up on the second trip-out, further unsynchronized enclosures are blocked.

Relay-Breaker Coordination . . . Unfortunately, operation of the fault detector relay does not follow the empirical current curves used in determining circuit breaker performance. The curves used in determining circuit breaker duties correspond to curve (b) in Fig 2. Because there will be some delay in the opening of the breaker, an instantaneous relay will have time to operate and lock out reclosing.

The pickup of the high-speed overcurrent fault detector relay does not follow the rms value of the first loop of fault current. The first offset loop determines whether the breaker rating is to be exceeded.

Operation of the relay is an inverse function of the system fault impedance angle which affects the magnitude of the offset current. In the TVA system, this is approximately 85 deg, which causes a reduction to about 85% of the normal pickup current. Therefore, to set the relay to trip at

(*Continued on page* 32)

(Continued from page 31)

TVA develops method for measuring fault by current lockout relays to guard breakers against overduty

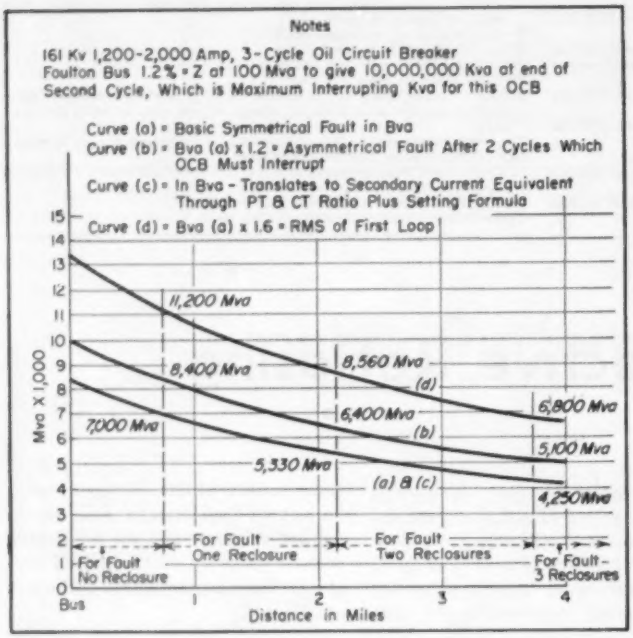

Notes
161 Kv 1,200-2,000 Amp, 3-Cycle Oil Circuit Breaker
Foulton Bus 1.2% = Z at 100 Mva to give 10,000,000 Kva at end of Second Cycle, Which is Maximum Interrupting Kva for this OCB
Curve (a) = Basic Symmetrical Fault in Bva
Curve (b) = Bva (a) x 1.2 = Asymmetrical Fault After 2 Cycles Which OCB Must Interrupt
Curve (c) = In Bva - Translates to Secondary Current Equivalent Through PT & CT Ratio Plus Setting Formula
Curve (d) = Bva (a) x 1.6 = RMS of First Loop
Mva X 1,000
11,200 Mva
8,400 Mva
7,000 Mva
8,560 Mva
(d)
6,400 Mva
(b)
5,330 Mva
(a) & (c)
6,800 Mva
5,100 Mva
4,250 Mva
For Fault No Reclosure
For Fault One Reclosure
For Fault Two Reclosures
For Fault - 3 Reclosures
Bus
Distance in Miles

FIG 2—ALLOWABLE RECLOSURES are determined by the current in the short circuit. The curves give the relay current values established by the distance from bus

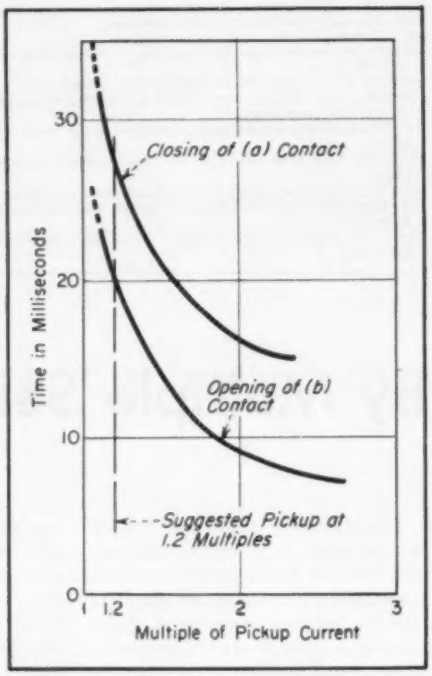

Time in Milliseconds
Closing of (a) Contact
Opening of (b) Contact
Suggested Pickup at 1.2 Multiples
Multiple of Pickup Current

FIG 3—RELAY TESTS with sine wave current developed curves relating operating time and pickup current

8,400 Mva, this formula is used:

Relay setting =

$$\frac{\text{Symmetrical fault current}}{1.2\ (\%\ \text{of pickup due to offset})}$$

The value 1.2 (multiple pickup Fig 3) may be varied slightly in individual relays. Relays should therefore be tested with a sine wave current to obtain a curve of operating times versus multiple of pickup, as shown in Fig 3. This permits use of the cutoff of the relay to prevent unnecessary blocking of the reclosures for faults less than the breaker interrupting ability.

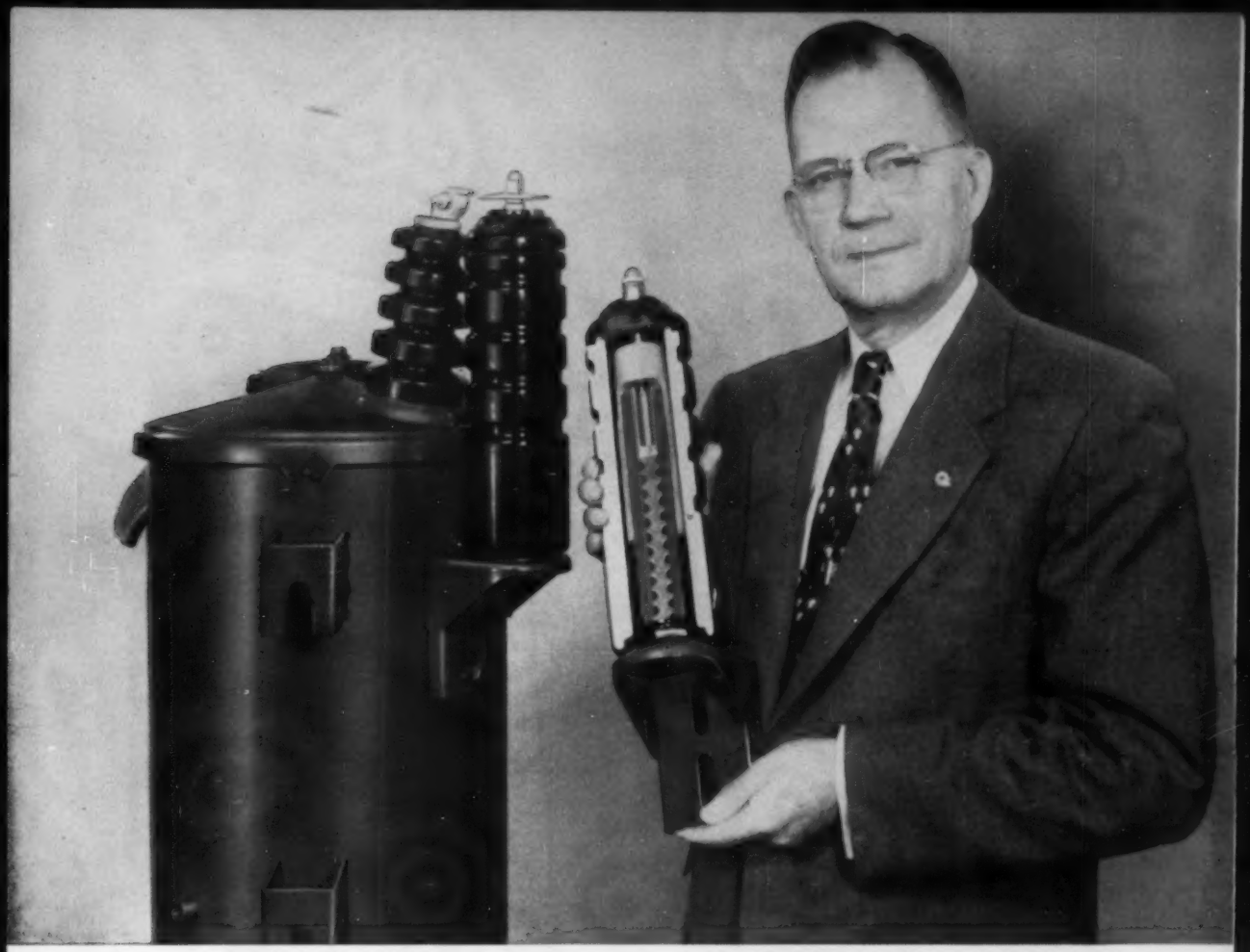
Operation of the relay during the first fault cycle must determine the allowable fault current, after 2 cycles, which the breaker must interrupt. The other two reclosers and their lockout relays can be set in the same manner at 6,400 and 5,100 Mva. Further complexity in the use of the current relay arises from the fact that nine relays are required, three per phase for each of the recloser fault ratings. Plunger type relays also involve careful calibration of individual relays around the pick-up point. They may vary as much as 10% in either direction because of residual magnetism, friction, and manufacturing tolerances encountered.

Alternate Method . . . Another method of setting up reclosures to meet the breaker interrupting capacities makes use of thyratron tubes to cut off on the crest of the first current loop, which will determine the correct rms value of the fault at the time the breaker parts contact. This method is faster in determining whether lockout is necessary. The thyratrons are not extremely accurate in their cutoff points, however, and careful tests must determine the action of particular types of tubes.

Check Transient Stability . . . While a method of providing three fast reclosures has been developed, a check for transient stability on the ac network analyzer is desirable. This has been done in each particular application, and in the example the swing curves of the close-in plant and the system are shown in Fig 5. Swing curves were stopped after the third trip-out because it was seen that stability was not threatened.

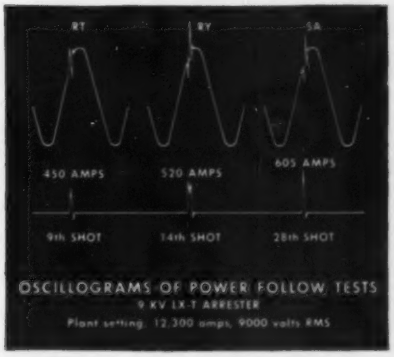
Synchronism Check Relay . . . Despite careful planning many normal chances of reclosing may be lost. To get the line back in service as rapidly as possi-

(Continued on page 36)



W. A. Sumner, Manager, Distribution Transformer Engineering, explains this

FACT: New Valvex expulsion arrester has greater current-limiting ability



Inherently dependable, the new LX-T retains the time-proved features of De-ion® expulsion arresters... large surge-current ability, low discharge voltage, long life, and ability to handle surges at 60 cycles overvoltages. Now it also incorporates new, low, spark-over voltages with greatly increased current-limiting ability for dynamic current on repeated tests at maximum severity.

It's another feature that spells more for your transformer dollar when you buy Westinghouse.

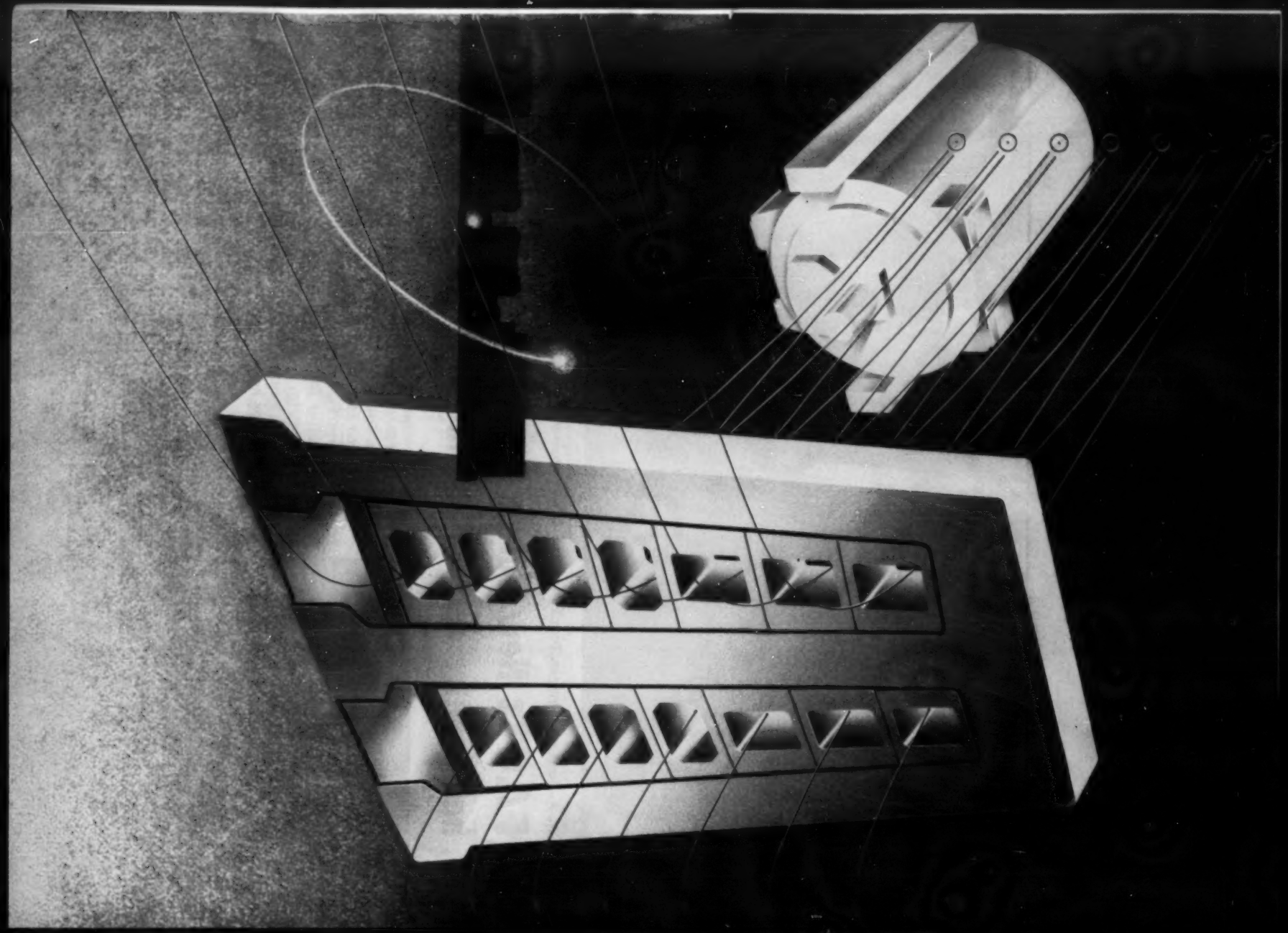
• • •

Get the facts from The Man With The Facts, your Westinghouse Sales Engineer. Or write direct to Westinghouse Electric Corporation, 3 Gateway Center, P. O. Box 868, Pittsburgh 30, Pa.

J-70737

YOU CAN BE SURE...IF IT'S

Westinghouse



Helping the industry meet its growing loads

Generator inner-cooling takes the heat out . . . to give you 275,000 kw and above on single shafts

Westinghouse ingenuity blows hydrogen *through* conductors, doubles capability, greatly reduces size and weight.

Generator ratings—and actual turbine-generator capability—have been at least doubled in the last four years, thanks to the successful efforts of Westinghouse engineers and technicians in effectively cooling vital areas. It has proved to be another example of Westinghouse ingenuity, paving the way for ratings never before thought practical —or possible.

Generator inner-cooling represents a tremendous advance in dissipating heat from current-carrying windings. It is sound in concept . . . direct and simple in application. Conventional hydrogen is blown at high velocities through the inside of rotor and stator conductors . . . in intimate contact with the copper where heat is generated. It is the most simple and effective cooling method ever devised.

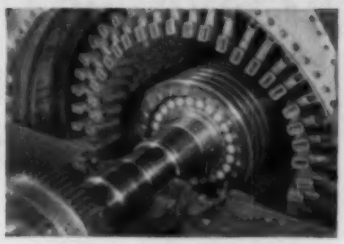
Already proved in extensive service, this inner-cooling has doubled single-shaft ratings over those attainable using conventional cooling. In the lower ratings, too, there is an appreciable reduction in size and weight.

Westinghouse inner-cooling has become the key to even greater generating capability. Appropriate refinements in coolant flow and pressures—ready to be applied as required—promise a sound and economical method for the large ratings required to meet your ever-increasing loads.

Producing kilowatts at the lowest possible cost is, as always, the moving force behind this singular Westinghouse achievement. It is one of the major reasons why turbine-generator capability has advanced *today* to 275,000 kw on a single shaft and shows real promise of surging to 350,000 kw and beyond within a very short time . . . meeting demands for larger, more efficient units producing more and more kilowatts from given volume and weight. These are Westinghouse answers to producing kilowatts at the lowest possible cost . . . to help the industry meet its growing loads more efficiently, reliably and economically. J-97182

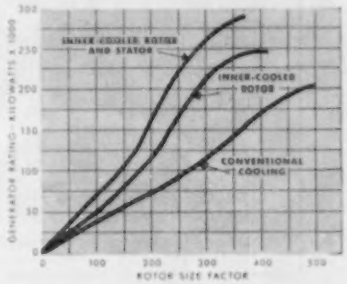
YOU CAN BE SURE . . . IF IT'S Westinghouse

Inner-cooled Generators



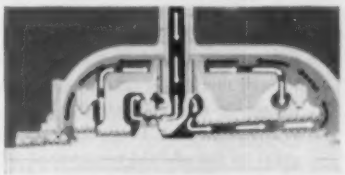
This is an end view showing the stator windings of a 100,000-kw inner-cooled generator. The ducts bring the hydrogen into intimate contact with the conductors, eliminating heat flow paths through the steel and high-voltage insulation.

With inner-cooling, it is possible to build single-shaft, turbine-generator units of much greater capabilities and to reduce the size and weight for smaller ratings.



Westinghouse success and experience with generator inner-cooling give current models a great margin of technical superiority. The chart above shows the extra capability possible through application of this Westinghouse-perfected technique.

Turbine-Generators . . . 275,000 kw and beyond



New turbine technology is equally as dynamic as the generator achievements described here. Mass-flow cooling, to name one, is another technique used by Westinghouse to cool vital areas. Here, cooled, partially expanded steam passes between inner and outer casings. Result: Temperature differentials are greatly reduced; the thinner walled casings adapt quickly to changes in load, starting and stopping. Mass-flow cooling is already being used on a new 275,000-kw super-pressure turbine-generator and will become another major factor in increasing turbine-generator capability to ranges never before thought practical or possible.

Breaker Performance Improved

Selection of Conditions for Fast Reclosing Cycle Extends Use

(Continued from page 32)

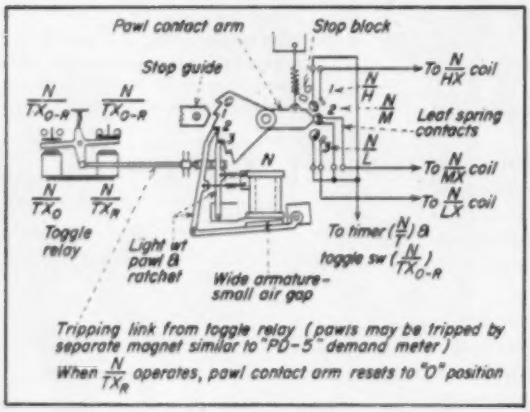

Pawl contact arm
Stop block
Stop guide
To N/HX coil
Leaf spring contacts
To N/MX coil
To N/LX coil
To timer (N/T) & toggle sw (N/TXO-R)
Toggle relay
Light wt pawl & ratchet
Wide armature-small air gap
Tripping link from toggle relay (pawls may be tripped by separate magnet similar to "PD-5" demand meter)
When N/TXR operates, pawl contact arm resets to "0" position

FIG 4—NOTCHING RELAY is designer's conception of electromechanical operation of the relays which are marked "N" in Fig 1

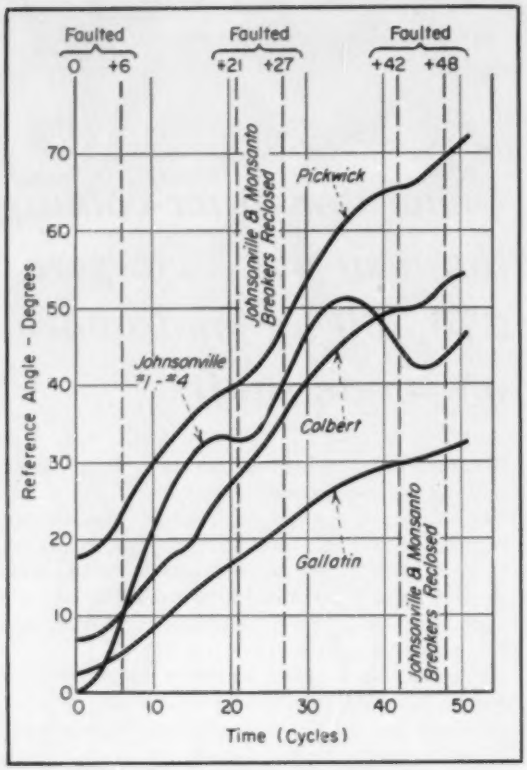


FIG 5—EFFECTS OF RECLOSING breakers on line faulted at one end are shown by swing curves developed from checks on analyzer

ble after failure or lockout of the fast reclosers, a fast synchronism check relay is provided.

Basically, this check relay determines in less than 25 cycles whether two voltages on opposite sides of an open breaker are in synchronism, even though there may be a phase angle between the two voltages due to the system being split. This angle may be as great as but should not exceed 90 deg at the instant the breaker contacts make after the fast synchronism check relay gives the signal to close.

Breakers involved ordinarily have an average closing time of 17 cycles. The problem is to predict the angle between the two voltages at the end of this closing time based on measurements made before the beginning of the closing operation. It is assumed that any increase in the angle θ between the two voltages occurs at a constant rate over the complete reclosing cycle. This is a reasonable approximation as the breaker is open most of the time. Then, the rate of change of θ can be measured before the closing indication is given and can be used to block reclosing if the indication is that θ will be greater than 90 deg at the time the breaker contacts make. Reclosing may also be allowed if θ is not changing but is less than some maximum angle, 90 deg on the TVA system.

The problem in determining whether a synchronism check relay will close its contacts is a function of the magnitude of the voltages compared and the angle or rate of angle change between the voltages. In many cases of a line trip-out not involving synchronism, synchronism check is merely a determination of voltage magnitude. In other cases the line may be a tie line, and the systems may start to drift apart when the line trips out. Fast reclosing frequently makes it possible to reclose before the systems have drifted out of step. If the angle change can be determined quickly, it may be possible to catch the systems if a reclosure has failed the first time.

One method of making the measurement of maximum angle is to use the fixed breaker and relay times to indicate elapsed time and a phase-angle relay to indicate angle, the result being an indication of rate of change of the angle θ.

The simplest scheme for providing the phase-angle measuring function consists of two high-speed phase sequence relays, one connected to produce torque reversal at 80 deg leading and one at 80 deg lagging. The control circuit must include a lockout arrangement so that, if the high-speed phase sequence relays do not permit reclosing at the end of the "delay" period, the circuit is not left set up to permit reclosing when θ next becomes less than 80 deg, with possibly too high a slip frequency.

ROEBLING TELLURIUM ALLOY LEAD SHEATH ASSURES FAR LONGER CABLE LIFE

Structure of Roebling Tellurium Alloy is shown in these Laboratory photomicrographs ... at left, before heat treatment ... at right, after treatment at 400°F. Note that little or no grain growth is apparent after heating. A fine grain size is desirable in regions of higher stress, as in duct splices.

BIGGER LOAD REQUIREMENTS! Higher temperatures! Increased movement of cable during load cycles! Today's best answer to each of these conditions is Roebling Paper Insulated Cable with Tellurium Alloy Lead Sheath*—the Roebling lead alloy that has completely superior resistance to fatigue.

In addition, Tellurium Alloy Lead Sheathed Cable has a lower long-time creep rate ... high bursting strength ... remarkable stability under heat application as in duct splicing and wiping. And on top of that, it eliminates need for frequent stop joints or reinforced lead sheath ... does not require generous expansion bends or large manholes.

Write us now for full information. John A. Roebling's Sons Corporation, Dept. 707, Trenton 2, New Jersey.

*Licensed under Patent 2588093 March 4, 1952 and App. No. 308710, Sept. 9, 1952.

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"Thank You, Mr. Mullen"

An inquiry came across our desk recently for the names of distributors of Manson tape in Minneapolis. What snared our attention was the closing line in the note, "This is the 'best tape' that we have ever used, and we would like to obtain more." The writer, Mr. W. H. Mullen of the Bernard L. Dalsin Company of Minneapolis,

you can be assured, was answered promptly.

The Dalsin Company is not a big user of tape, they required only several rolls—but they did like it and took pains to get a new supply. This, we are certain, is the best testimonial to a good product.

Tape users everywhere have found that Manson tape is definitely a superior product. It is unequalled in true adhesiveness, and will retain this quality over extremely long periods. It is a true friction tape made of a closely woven cotton fabric into which has been frictioned only new, naturally tacky rubber compounded with the best chemical ingredients.

Okolite, Okoprene and Manson tapes make splices that will be tight and waterproof far longer than ordinary tapes, and consequently reduce maintenance costs. It's "spliced for life" when you use Okonite premium quality tapes.

Write for a set of instruction sheets EW 5678; they will help solve your splicing problems.

...when you splice with:

AVAILABLE THROUGH AUTHORIZED DISTRIBUTORS ONLY

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Made by
THE OKONITE COMPANY
PASSAIC NEW JERSEY
SINCE 1878

SPECIALISTS IN ELECTRICAL WIRES, CABLES AND SPLICING MATERIALS FOR 75 YEARS

PCEA Boosts Intensive Selling

Delegates at Business Conference search for methods to overcome inadequate-wiring block and study sales promotion

Resurrection of intensive selling in the California-Arizona region was indicated by the more than 300 delegates who attended the Business Development Section, Pacific Coast Electrical Association annual conference at Fresno, Calif., Jan. 27-28. Both Southern California Edison Co and Pacific Gas & Electric Co, hitherto restrained from intensive effort by lack of capacity, had new load building programs to exhibit to an industry anxious for such support.

Adequate Wiring a Necessity . . . But the perennial problem, inadequate wiring, was a factor in all the deliberations, and delegates searched the industry's experience for methods that might be used to overcome this roadblock. All groups recognized the customers' lack of wiring as the first job the industry must tackle.

For the past two years this section has taken a program of speakers on the road to eight or ten cities in its territory. This year saw a return to the discussion conference single meeting. This was significant of the changed atmosphere and the desire for interchange of methods and ideas by all companies.

PCEA president, R. N. Dreiman, Pacific Gas & Electric Co, opened the meeting with a brief message from management on "Today's Need for Developing Business."

Realistic Programs Asked . . . Two featured luncheon speakers brought the appliance business to the forefront. Pres H. B. Price, Jr, National Appliance and Radio-TV Dealers Association, urged utilities to appreciate the three classes of dealers in the formulation of their programs. These classes are the "mama-papa" small dealerships who are unable to finance the salesmen and advertising often asked of them, the specialty dealers who concentrate on appliances and will participate in utility promotional programs, and the big merchandising firms to whom appliances are but one small part of their business. He urged that the programs be tailored realistically to meet these three types of operation.

O. R. Doerr, PG&E vice president of sales, closed the two-day conference with a presentation of the EEI-NEMA wide-screen spectacular "After 75th Anniversary, Where Do We Go?" This "spectacular," using three projectors and a wide screen, soon will be made available for presentation throughout the country. Forecasting a 428 million appliance production in the next five years, the movie shows what this will mean in apparatus, equipment, and wiring sales. Assisting Doerr in this presentation were W. P. Creech, Westinghouse Appliance Division, Mansfield, Ohio; Kurt Steindorf, General Electric Co, San Francisco; and Matt Sherwood, field director, NECA, San Francisco.

The agricultural load building committee heard of a move of the California legislature to require state permission for any future water well drilling and asked the PCEA directors to investigate such a restrictive measure.

Tremendous interest was shown in room coolers and heat pump potentials in a committee headed by C. V. Soper, Southern California Edison Co.

Model Homes Can Sell Lighting . . . That home lighting can best be approached by setting examples in model homes on display was the most pertinent program presented to this committee. With this program adequate wiring can be sold to home builders. Financing plans and the need to sell tract home builders on their own NAHB voluntary new wiring standard were discussed. Education of appraisers to the new standards was considered vital.

The home economics group headed by Christine Dent, Westinghouse Electric Corp, reported excellent educational results from its workshop sessions with home economics teachers. Workshop sessions will be held to train dealers' personnel in appliance demonstration and selling.

Industrial Heating Parley Planned . . . The commercial and industrial power group agreed on an industrial heating one-day conference to bring together top industrial executives to develop more industrial power applications. The NEMA certified lighting program for commercial and small industrial premises was explained by Leonard Hobbs, Smoot-Holman Co, Los Angeles, and a member of the NEMA committee. Robert Schwartz, Oakland contractor, told the group that the luminous ceiling business may slip away from the electrical industry unless manufacturers assist contractors and contact architects to make this a part of the electrical system.

Section Chairman J. A. Corlette, General Electric Co, San Francisco, and Vice Chairman J. H. Adams, Southern California Edison Co, presided at the luncheons.

Higher Service Voltage

(*Continued from page* 27)

Apparently this voltage is proposed primarily because of fluorescent lighting and has no other application. If this voltage were to encourage the development of other equipment, it would defeat the industry's efforts to get off the treadmill resulting from the multiplicity of operating voltage levels. The industry should preserve the advances which have been made toward standardization of utilization voltages. These advantages are reflected in the joint EEI-NEMA Report mentioned. Recommendations made in this report are compatible not only with the consensus of usage in this country but also serve as a basis for standardization on a world wide level.

A common voltage base would also help to remove an important barrier to the development of foreign markets for American-made appliances. Most American manufacturers feel that they cannot afford to make special appliances for the foreign markets.

Although utilities do not now require a higher utilization voltage, nevertheless a decision must be made to guide selection of a new service voltage which will best suit future needs. The problem should be studied now by all utilities even though action may be deferred indefinitely.

PUC's Urged to Consider Budgets

P. E. REMINGTON, Vice President, Mountain States Telephone & Telegraph Co, Denver, Colo.

Future operating budgets and inflation's effect on the value of utility stocks are two factors due more consideration by regulatory commissions in setting the rates for public utility companies. Gains in this direction are encouraging but not very impressive. Regulatory bodies have not yet fully recognized the need for consideration of the budget for proper rate regulation.

Federal regulatory commissions and some state bodies are beginning to see that the long-run interests of the customer will be best served as long as the utility investor is treated fairly. This trend can be accelerated by help from the utility industry and by winning the support of all businesses that are vitally interested in strengthening the free enterprise system.

Rates Reflect a Balance . . . The purpose of regulation is to set prices that reflect a balance between consumer and investor interests. Regulation properly should place a check upon profits similar to that which competitive businesses earn. But it should not deny reasonable profits if the value of the product is such as to make this possible. One rather common misapprehension regarding public utilities is that they are somehow guaranteed a fair return. Public utilities are assured only the same right as other business to produce a product of such value that it can be sold at a profit.

The process of rate-making for public utilities should resemble the fixing of prices in competitive industries. The law is well settled that rates established under regulatory authority can only apply for the future. This immediately suggests that public utility prices should be based upon a budget of operations for a future period. In a few states this logical procedure is possible. It operates through laws that permit rates to be put into effect under bond or through consideration by commissions of the future budget upon which the utility has based its requested rates.

Most, if not all, utility rate cases involve the amount of revenues, expenses, and net earnings under the existing and proposed rates, the value of property being employed, and the ratio of net earnings on that property, as contrasted with what the commission determines to be a fair rate of return.

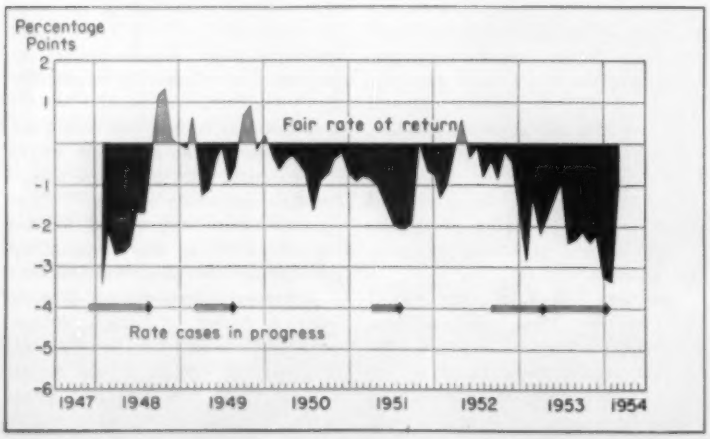
In an atmosphere of legal proof and of opposition it often happens that the only evidence given real consideration is that based upon a "representative" period in the past. And even in inflationary times, future estimates have been rejected because the regulatory commission felt it could not rely on what might be self-serving statements of the utilities.

Dollar Worth Only a Half . . . During the last decade or more, the country has gone through a period of extensive inflation. Currency in effect has been devalued until the 1940 dollar is worth only about 50¢. Prices now seem to be stabilizing at the new high level. This produces circumstances that strongly affect utility regulation that is limited to consideration of the recorded past on the books of account.

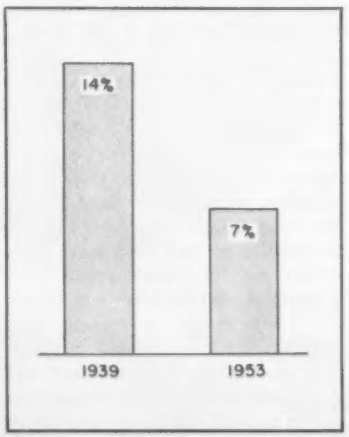
Some of these effects are:

1. When utility expenses are increasing steadily under inflationary pressures, past expenses do not adequately reflect the higher future expenses. And it is during the future that the rates will be in effect. Adjustments for known higher levels of items, such as wages or taxes, are not adequate today fully to take care of the general increase in costs.

2. Use of a past period as the test period usually means that rates will be inadequate. This must first be proved



FAILURE TO EARN the approved rate of return was a state commission requirement before the utility could seek relief. Earnings were about 80% of what commission sought to provide



UTILITY EARNINGS as a percent of the total U. S. corporate earnings have fallen 50%

in Setting Fair Treatment of Rates

by experience after which extended hearings must be held before relief is afforded.

The effect of these two items on the earnings of the author's company in one of the states served is illustrated below. Five rate applications were made in six years. Each time the commission granted only part of the request, basing each order on the past 12-month period. Over the entire period earnings aggregated only about 80% of what the regulatory commission itself intended the company should have.

Two other items relate to the use of book figures without adjustments. They would apply equally well to a past test period or the budget for a future period. Depreciation is an expense that must be included in arriving at the net earnings of the property. Depreciation costs included on the books of account are based upon the original dollar costs of the property, but they are being repaid through depreciation allowance stated in 50¢ dollars. Thus, they fall far short of repaying the real capital being consumed in operations. Competitive industries in fixing their prices are making allowances for inadequacy in the depreciation expense. However, the use of the book depreciation for price fixing of regulated utilities tends to prevent this.

Effect of Inflation . . . Exclusive use of the books of account to determine the rate base means that the return granted is not related to the actual present value of the property. Rather, it is based upon the dollars historically invested in the property. For example, assume that 7% is a fair rate of return. Then the return allowed on $1 invested in 1940 becomes seven 1954 cents or only 3½% on the purchasing power originally invested.

There are a number of ways in which recognition can be given to depreciation and actual property values. If the rate of return on the utility's book capital were comparable to that earned by other businesses on their book capital, earnings automatically would contain an allowance for the changed value of the dollar. Or if depreciation expenses and property are both expressed in present values, then a fair rate of return need be no more than is necessary to attract new investors.

This philosophy of using future estimates has been employed successfully since 1947 by a commission in one of the Mountain states. Rates have been reasonable, earnings moderate, and intervals between rate adjustments longer than in most states. Both the commission and the utility have recognized they are associated for the long pull in a joint responsibility for good service to the customer.

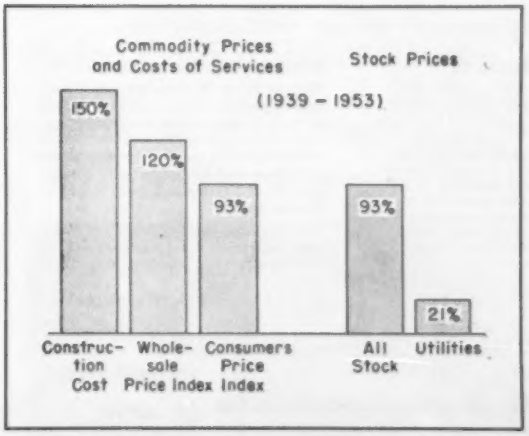
Utility Earnings Have Not Kept Pace . . . The regulatory procedure which needs changing has made serious inroads into the financial position of public utilities in recent years. The year 1939 is most often selected as being a fairly normal prewar year. As illustrated in one of the charts, profits of all electric, gas, and telephone utilities in 1939 represented one-seventh of the profits earned by all corporations (reported by U. S. Commerce Department). In 1953, based on preliminary figures, profits of all these utilities represented only one-fourteenth of the total profits of all corporations.

The result of this financial starvation of utilities is reflected in the comparative market price of their common stocks. These are shown in chart below (as reported by U. S. Commerce Department). The first three bars show inflation's rise since 1940. The next bar show that since 1939 the market price of the average share of common stock in all U. S. corporations has increased 93%. Since 1939 the value of the dollar has been cut about in half. Thus, common stocks as a whole have increased enough to offset the devaluation of the dollar.

Stock Values Held Back . . . By contrast, however, the value of the average public utility share has increased only 21%. When the devaluation of the dollar is considered, the average utility shareholder has found a substantial part of his investment has been taken away. As the utility companies' share of the earnings of all businesses dropped by more than 50%, it is only natural that utility stocks should not maintain their comparative market position.

Continuation of this trend might starve our public utilities into such impotence that they would be incapable of continuing these vital services. Some people contend that utility common stocks properly should be compared with bonds, life insurance, retirement annuities, and other investment whose owners are trapped by inflation. But the difference between equity and contracted senior obligations should be so obvious as to require no discussion in this article.

Secretary of Commerce Sinclair Weeks said in 1953: "In regulating utilities . . . it is cheaper for the public in the long run to have those that serve it well-fed and strong rather than half-starved and weak. There are ways of getting good service out of the strong. No one can get it out of the weak."



PRICE ADVANCES of most items except utility stocks have moved with the inflationary spiral. Continuation could starve the utilities

No loose connections . . . greater safety for linemen with the *NEW* LOCKED LOW VOLTAGE BUSHING . . .

on Wagner Form W Distribution Transformers

Here's just one of the many important extra features that you get when you buy Wagner Pole Type Distribution Transformers. Wagner's *new* locked low voltage bushing on Form W Transformers is key-locked to prevent rotation. A projecting key in the tank opening fits in a groove on the porcelain. The terminal is locked to the porcelain in a similar manner so it is impossible for the bushing assembly to slip or turn when the terminal is being tightened or loosened.

This means . . .

1. No loose connections on the inner end of the terminal studs because it is impossible for these studs to turn when the terminals are being tightened.
2. Greater safety for the lineman when connections are being made to the terminal.

Wagner Form W Transformers have these ADDITIONAL FEATURES . . .

SHUR-SEAL COVER — INHIBITED OIL

Form W Transformers come with the Wagner Shur-Seal Cover and are filled with an *inhibited oil*. The Shur-Seal Cover makes a *positive* seal which prevents oil contamination caused by "breathing" of atmospheric moisture and dust particles. The inhibited oil reduces oxidation to a minimum and retards the formation of acids and sludge which cause rapid transformer deterioration. Together, these features add years to the life of Wagner Form W Transformers.

NOW SHIPPED TO YOU IN DRUMS

Wagner Form W Distribution Transformers from 3 to 10 kva are now packed in sturdy fiber drums for ease of shipping, handling and storage. Each drum is sealed so that when it is opened, the transformer is as clean and free of harmful foreign particles and grease as the day it left the Wagner plant.

Write for your copy of Bulletin TU-180. It gives complete information on Wagner Distribution Transformers.

WAGNER ELECTRIC CORPORATION
6456 PLYMOUTH AVE., ST. LOUIS 14, MO., U.S.A.

BRANCHES AND DISTRIBUTORS IN ALL PRINCIPAL CITIES

ELECTRIC MOTORS
TRANSFORMERS
INDUSTRIAL BRAKES
AUTOMOTIVE BRAKE SYSTEMS—AIR AND HYDRAULIC

TU8-7

CHARLES E. KOHLHEPP

Kohlhepp to Head JCP&L

Succeeding E. H. Werner as president of Jersey Central Power & Light Co will be Charles E. Kohlhepp, president of Wisconsin Public Service Corp. Kohlhepp will assume the presidency of the New Jersey utility when Werner's retirement become effective on April 1.

Kohlhepp's association with Wisconsin Public Service started in 1920. After successively being auditor, vice president and general manager, he was elected president in 1948. Before joining the Milwaukee utility, he was employed by Consolidated Gas, Electric Light & Power Co of Baltimore.

Werner was elected president of Jersey Central P&L in 1945. Prior to his election as head of the New Jersey organization, he was president of Pennsylvania Edison Co, now a part of Pennsylvania Electric Co. His affiliation with that utility was preceded by employment in executive capacities with both Metropolitan Edison Co and Reading Transit & Light Co.

Buchsbaum Is Elevated

Joseph S. Buchsbaum has been named general sales manager of Standard Transformer Co, Warren, Ohio. Buchsbaum has been with Standard for the past 12 years as sales promotion and advertising manager.

Prior to joining Standard, he worked with Ohio Public Service Co, now Ohio Edison, for 20 years.

J. S. BUCHSBAUM

Myers Is Named a VP

John F. Myers has been elected a vice president of Westinghouse Electric Corp. Myers, who was also made general manager of consumer products, is replaced as president of Westinghouse Electric Supply Co by Victor Kniss, formerly general sales manager for Westinghouse's consumer products group.

J. F. MYERS

Philco Corp Appoints Three Vice Presidents

Philco Corp, Philadelphia, has announced the election of three new vice presidents.

Joseph A. Lagore has been named vice president of manufacturing and James D. McLean vice president of sales of the Government and Industrial Division.

J. A. LAGORE

J. D. McLEAN

W. H. OELKERS

Wilson H. Oelkers has been appointed as vice president in charge of purchasing for the Philadelphia firm.

For the past three years Lagore has been general manager in charge of operations of the Government and Industrial Division. McLean has been general sales manager of that division since 1949. Lagore joined Philco in 1928 as a tester on the radio production lines and McLean began with Philco in 1947 as commercial manager for firm's Philadelphia television station.

Oelkers has been general purchasing agent for Philco since 1952. Oelkers joined Philco in 1934.

Central Hudson Advances Sillin, Furlong

L. F. SILLIN, JR.

Central Hudson Gas & Electric Corp, Poughkeepsie, N. Y., has announced these executive appointments:

Lelan F. Sillin, Jr, was elected vice president and a member of the board of directors. Joseph F. Furlong was elected to the position of secretary and was appointed assistant treasurer.

In addition to his responsibilities as vice president, Sillin will continue his duties as assistant general manager. Since joining the utility in 1951, he has served as secretary and assistant treasurer, and assistant general manager for the past two years. He also worked for five years with the utility's general counsel, Gould & Wilkie, New York. Furlong has been assistant secretary since 1952, prior to which he served in cost and rate department.

J. F. FURLONG

Ormston Promoted

A. J. ORMSTON

The promotion of Alfred J. Ormston to the post of chief mechanical engineer has been disclosed by Florida Power Corp. He succeeds the late Paul L. Bortow (EW, Jan. 31, p 39).

Ormston joined the utility in 1939, advancing to assistant chief mechanical engineer in 1951.

Parrish Advanced

E. M. PARRISH

Earl M. Parrish has been made general superintendent of power stations for Duquesne Light Co. He succeeds Thomas E. Purcell, who retired recently (EW, Dec. 13, p 242).

Parrish began with Duquesne Light in 1926. He filled various engineering posts before becoming operating engineer in 1950.

PERSONALS

John B. Dempsey, Detroit branch manager for Thor Power Tool Co, Aurora, Ill., has been made manager of electric tool sales. Dempsey has been a member of the Thor sales department for nearly 17 years.

Philip D. Parker, general sales manager of General Electric Co's Lamp Division for the past several years and with the company for nearly 39 years, has retired.

Michael J. Chesmar, secretary and treasurer of Hubbard & Co, has retired after 38 years' service. He assumed the present posts in 1944.

Fred H. Dettmar, who has been in charge of Dayton Power & Light Co's public relations and advertising, has been named manager of the newly formed Information Services Division, which will be composed of the public information department and the advertising and publications department.

In another appointment, **Dallas E. Foreman,** who came to Dayton P&L in 1951, was appointed supervisor of the new division's public information department.

William J. Gorman has been appointed merchandising manager of Jefferson Electric Co, Bellwood, Ill. Prior to joining Jefferson, Gorman was in the statistical research department of the Fibre Box Association, Chicago.

H. W. Cory has been promoted from assistant chief engineer to chief engineer of control engineering at the Hawley Works of Allis-Chalmers Manufacturing Co. Since joining A-C in 1941, Cory has been associated with its control operations.

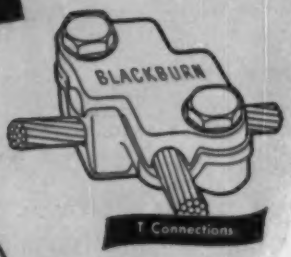
Waldo Porter, chief electrical engineer at the Vancouver, Wash., works of Aluminum Co of America since 1949, has been assigned to the newly created position of power manager for the firm's Northwest operations. Porter, an Alcoa employee since 1936, will be concerned primarily with the company's power needs for smeltering, extruding and fabricating works at Vancouver and the smeltering operations at Wenatchee, Wash. Moving up to Porter's job is **W. E. Lawton,** who has been at Vancouver since last September.

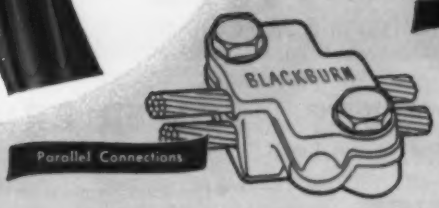
OBITUARY

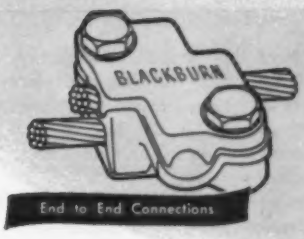
David A. Elias, 70, former vice president and general manager of the Harrisburg Division of Pennsylvania Power & Light Co, died recently at Harrisburg, Pa. Elias became Harrisburg's city comptroller in 1950, after retiring from the utility in 1949. He went to Harrisburg in 1921 to manage PP&L interests.

You can handle a wide variety of jobs with this

Stronger, More Versatile BLACKBURN *Cross Tap* CLAMP







Get quick service for a large number of different connection and wiring jobs with BLACKBURN'S Cross Tap Clamp.

- **Eight connectors accommodate cable sizes from #6 to 1000 MCM.**
- **Made of high strength copper alloy; silicon bronze bolts; phosphor bronze shakeproof lockwashers.**
- **Rounded edges for easy taping.**
- **Greater wrench rotation with either end or socket type speeds installation.**
- **Available from Electrical Distributors everywhere.**

* ***Also available completely tin plated for general purpose work.***

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MEETINGS

Week of Feb. 13-19

NATIONAL ASSOCIATION OF PURCHASING AGENTS

24th Annual Mid-Winter Conference, Public Utility Buyers' Group, Shamrock Hotel, Houston, Tex., Feb. 13-15.

EDISON ELECTRIC INSTITUTE

Industrial Relations Committee in conjunction with AGA at AMA Mid-Winter Personnel Conference, Palmer House, Chicago, Feb. 14; Electrical Equipment Committee, Deshler Hilton Hotel, Columbus, Ohio, Feb. 14-15; Commercial Electric Space Heating and Air Conditioning Committee, Terrace Plaza Hotel, Cincinnati, Ohio, Feb. 17-18; Residential Promotion Committee, New York, Feb. 20-21; Accounting Conference, Planning, Edgewater Beach Hotel, Chicago, Feb. 17-18.

PENNSYLVANIA ELECTRIC ASSOCIATION

Winter Meeting, Prime Movers Committee, Roosevelt Hotel, Pittsburgh, Feb. 14-15; Winter Meeting, Relay Committee, Hotel Roosevelt, Pittsburgh, Feb. 15-16; Winter Meeting, Electrical Equipment Committee, Benjamin Franklin Hotel, Philadelphia, Feb. 17-18.

NATIONAL RURAL ELECTRIC COOPERATIVE ASSOCIATION

Annual Meeting, Convention Hall, Atlantic City, N. J., Feb. 14-17.

Week of Feb. 20-26

CALIFORNIA MUNICIPAL UTILITIES ASSOCIATION

24th Annual Conference, Hotel Senator, Sacramento, Feb. 22-25.

PACIFIC COAST ELECTRICAL ASSOCIATION

Conference on Electronic Integrated Data Processing, Hotel Statler, Los Angeles, Feb. 23-24.

NATIONAL ADEQUATE WIRING BUREAU

11th Annual Conference, La Salle Hotel, Chicago, Feb. 24-25.

PENNSYLVANIA ELECTRIC ASSOCIATION

Systems Operation Committee, Abraham Lincoln Hotel, Reading, Pa., Feb. 24-25.

Week of Feb. 27-March 5

SOUTHERN SAFETY CONFERENCE-EXPOSITION

Jung Hotel, New Orleans, La., Feb. 27-March 1.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS

1st International Congress on Air Pollution, Hotel Statler, New York, March 1-2.

EDISON ELECTRIC INSTITUTE

1st Street Tree and Utility Conference, co-sponsored by EEI Transmission and Distribution Committee, Street Lighting Committee of Illuminating Engineering Society and National Shade Tree Conference, Wade Park Manor, Cleveland, March 3-4.

4 Co-ops in Alaska Set Up Group to Develop Hydro

A Central Alaska Power Association has been organized by four Rural Electric Administration cooperatives to develop hydroelectric power on the Kenai peninsula. Articles of incorporation establish a $100-million debt limit for the new generation and transmission cooperative.

Herman Schultz of the Homer Electric Association is chairman of the new association, with Art Schroder of Kenai Lake Electric as vice president, Mrs Justine Parks of Matanuska Electric as secretary-treasurer, and Ed Jarvi of Chugach Electric and John King of Homer Electric as directors.

The association would develop hydroelectric projects, as required, to "create a cheaper source of power so badly needed by the various systems," said Schultz. "Since private capital has shown little interest in undertaking such projects, the co-ops decided to band together in order to borrow 2% money from REA, which is the cheapest money available in Alaska and probably anywhere."

The City of Seward, which has proposed a 10,000-kw project at Crescent Lake, has expressed willingness to join the association, under certain conditions yet to be worked out, while the power committee of the Anchorage Chamber of Commerce has endorsed the proposal.

The association plans a transmission line that would connect the Kenai-Anchorage-Matanuska area from Homer to Palmer. Homer Electric has just energized 77 miles of distribution lines while Kenai Lake Electric soon will receive a $500,000 REA loan to construct lines from Seward up the Kenai River.

Citizens Utilities Loses Suit to Get Hoover Power

Citizens Utilities Co has lost a U. S. District Court lawsuit to compel the Bureau of Reclamation to continue providing hydroelectric power from Hoover Dam for use at Kingman, Ariz.

The utility had asked reconsideration of a suspended contract between the government and Citizens Utilities.

Citizens had been buying the power as surplus since 1941. Recently first claimants to the power—Metropolitan Water District of Southern California and Southern California Edison Co—exercised their demand.

To make up the deficit, Arizona Power Authority will feed needed power into the state system from Davis Dam with the approximate 5,000 kw supplied Kingman, Ariz., made up by feeding into the system steam power from Arizona.

POWER BRIEFS FROM THE NEWS

• Construction plans for 1955 have been announced by these utilities: Arizona Public Service Co expects to spend $16 million; Northern States Power Co, $51.5 million; Consumers Public Power District, Columbus, Neb., $6.6 million; Public Service Electric & Gas Co, $98 million; Pennsylvania Power & Light Co, $32 million; Southwestern Gas & Electric Co, $16 million; and Rochester Gas & Electric Corp, $16.7 million.

• Contracts totaling $2,306,690 for a new 66,000 kw generating system at its Dale power station at Ford on the Kentucky River have been awarded by East Kentucky Rural Electric Cooperative Corp. Full cost of the latest unit, the third, will be approximately $4 million. Completion of the new unit will give the plant by 1957 a record capacity of 106,000 kw, making it the largest rural cooperative plant in the United States.

• Australia's Snowy Mountains Authority has authorized Ebasco Services, Inc, to analyze power problems and costs in connection with the development of a large number of the agency's hydroelectric power projects.

• Southern California Edison Co's gross peak demand exceeded 2 million kw for the first time when the company delivered 2,002,100 kw of Jan. 18. Previous high demand on Edison's system was 1,998,200 kw recorded Dec. 9, 1954.

There's no room inside for "frozen" thinking. For steam power progress will be measured in the future, as it has been in the past, by a lack of inhibition characteristic of Americans when they face engineering and financial problems.

No matter what you do, no matter what you make, the heat, light, and power you need must in large part come from coal, oil, gas and other fuels. And steam will be the medium for transforming the energy in those fuels into useable power. That's why it is important to you that B&W engineers tackle each new job with the determination that it can and must be an improvement over the excellent jobs that preceded it. Their thinking about how to give you cheaper power is not hampered by "sacred-cows" or slavish obedience to past practice.

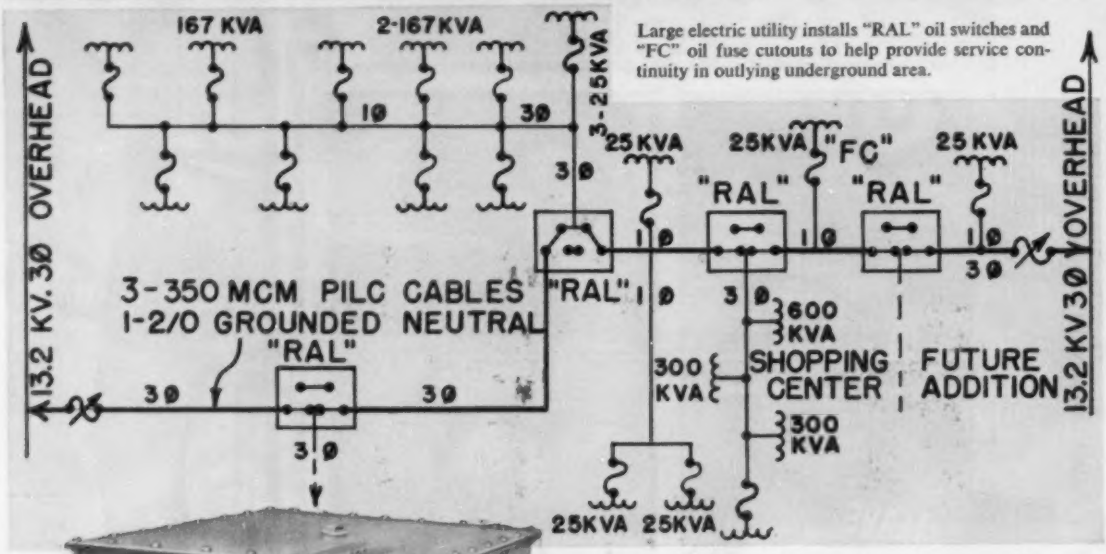
Today, plants all over America are operating more efficiently because of B&W steam-generating improvements like Cyclone Steam Separators, coal pulverizers, advances in oil and gas firing, Cyclone Furnaces, pressure firing, high-temperature alloy steels, shop-assembled steam generators, use of increasingly higher pressures and temperatures, and waste-heat boilers and similar heat recovery equipment.

The door is open for tomorrow's contributions to the remarkable science of steam generation. You can rest assured that B&W engineers will continue to pioneer in the search for better ways to convert the raw energy which lies dormant in coal, oil, gas and other fuels into high-level, useable energy for the common good.

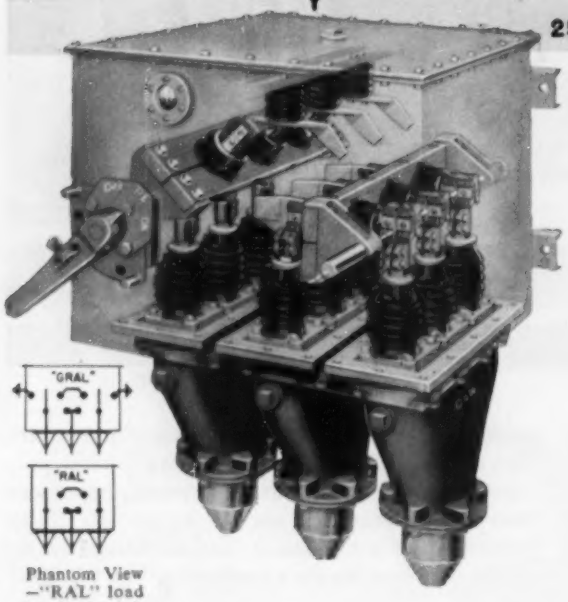
BABCOCK & WILCOX
BOILER DIVISION

H-183

G&W sectionalizing devices promote primary cable system flexibility



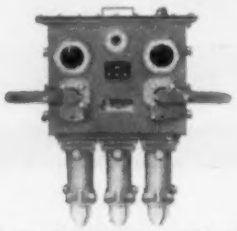
Large electric utility installs "RAL" oil switches and "FC" oil fuse cutouts to help provide service continuity in outlying underground area.



Phantom View —"RAL" load break oil switch 15 Kv.

The "RAL" loop through load break oil switches in the main cable run permit supplying the branch loads from either of the two overhead circuits.

The "FC" oil fuse cutouts serve as fuse-switches for the individual loads (3 phase and single phase).



Viewing windows in oil switch tank permit "seeing" whether the links are in the "ON", "OFF" or "GROUND" position.

"FC62" size oil fuse cutout is applicable to 13.2 Kv. solidly grounded neutral system.

Type "RAL" load break subway oil switches have provided safe and convenient means for sectionalizing cable circuits for over 20 years. They are reasonably priced, too. Why not send for the following bulletins and investigate the application of "RAL" switches and "FC" oil fuse cutouts to your distribution system.

Bulletin H49—Data on primary distribution system flexibility.
Bulletin DB51—Lists various types of "RA" oil switches.
Bulletin CA52—Data and prices on Type "FC" oil fuse cutouts.

G&W ELECTRIC SPECIALTY CO.
7780 Dante Avenue, Chicago 19, Illinois, U.S.A.

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In Canada—Powerlite Devices, Ltd.,
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CD551

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1905
50th ANNIVERSARY
1955

How Far Can Employers Go?

The government has drawn a hair-line rule on just how far employers can go in questioning their workers about union activities without violating the Taft-Hartley Act.

The rule was laid down by the National Labor Relations Board in a case involving the Graber Manufacturing Co of Madison, Wis., and the International Association of Machinists, AFL. It spelled out the area of permissable questioning and by so doing, found that Graber had acted illegally when its officials discussed the union with employees.

The gist of the decision is this: That management can seek information from employees to determine their support of a union, but it can not imply any threat or intimidation of those employees during the conversations.

By its ruling, the board qualifies a doctrine it issued last year. At that time the three-man Republican majority on the board overturned long-standing policy to permit employers to investigate a union's claim that it represented a majority of workers at the plant. Under the old board policy, any sort of interrogation about union activities, was an unfair labor practice under its interpretation of Taft-Hartley.

But, in the Graber case, the present four-member board ruled unanimously that the company had gone beyond the bounds of simple interrogation by making implied threats to union supporters.

The charge against the company was filed by the Machinists Union which subsequently lost a bargaining election at the Graber plant. It accused company officials of illegal interrogation of employees about the Machinists organizing activities. The board agreed that the company violated the law by these activities:

- A company official, in discussing the union with an employee, told her she "would be sorry" if the AFL Machinists came into the plant.
- Another official asked an employee to remove the union button she was wearing at the plant.

In the first event, the board found that this statement was intimidation of an employee and a clear violation of the law. The members decided this way even though a top company officer later told employees that they would keep their jobs whether or not the union won the election. The speech did not have the effect of purging the previous threat, according to the members.

On the second point, the board held that the request that an employee remove a union button would not have violated the act itself, but that it was a violation in combination with the threat against the employee.

The NLRB also noted that a particularly active union supporter was singled out for questioning. By all three actions, according to the board, the company showed that their questioning was "not limited to the matter of ascertaining union majority status" —the legal type of management interrogation—but "pertained generally to the employees' union activities, and more particularly, to union leadership."

This indicated a clear intention on the part of Graber to restrain or interfere with employees in the exercise of their rights, the members held. They followed up their ruling with an order to the company to post, for 60 days, a notice promising not to question their workers about membership or activities of the Machinists or any other union. Graber must not threaten reprisals for union activities or for wearing union buttons.

Eta Kappa Nu Names '54 Outstanding EE

Dr Ruben F. Mettler, right, is shown receiving the Etta Kappa Nu award as the "outstanding young electrical engineer" of 1954 from the society's national Pres Jesse E. Hobson. He is 30 years of age and is employed by the Hughes Aircraft Co, Culver City, Calif. At present he is on loan to the Department of Defense at Washington. He became the 19th winner of this award.

The four who received certificates of honorable mention were: Dr Edward E. David, Jr, of the Bell Telephone Laboratories, Drs Leon K. Kirchmayer and Lindon E. Saline, General Electric Co, Schenectady and Jackson F. Fuller of GE's Denver office.

America's Finest Suspensions...

THANKS TO VICTOR "KNOW-HOW"

and Purified Porcelain!

VICTOR No. 900
SUSPENSION

Every VICTOR Suspension insulator is the result of sound design, superior craftsmanship and VICTOR *Purified* Porcelain—finest insulator porcelain ever made! That's why they have improved thermal resistance, better mechanical and electrical characteristics and greater resistance to impact. Thanks to VICTOR's unique "know-how," you just can't buy a better suspension!

For the full facts on Victor "Know-how," write for "The Story of Victor and Purified Porcelain." For engineering data on all Victor insulators, write for Bulletin No. 4.

SPECIFICATIONS

Type.....ball socket	Leakage Distance.....11½"
60 cycle Dry Flashover.....80 KV	M and E Strength.....15,000 lbs.
60 cycle Wet Flashover.....50 KV	Impact Rating.....55 lbs.
Pos. Impulse Flashover*.....125 KV	RNI.....50 Microvolts
Neg. Impulse Flashover*.....130 KV	1000 KC at applied.....10 KV
Dry Arcing Distance.....7⅜"	

*Crest KV, 1½ x 40 microsecond wave Critical Value

FEATURES

1. Higher mechanical strength
2. Greater resistance to thermal variations
3. Unequalled uniformity of mechanical and electrical values
4. Unequalled resistance to impact
5. Specially compounded cement for maximum strength
6. Caps and pins scientifically designed to withstand pull far above NEMA specifications
7. All metal parts hot-dipped galvanized for maximum resistance to weathering and corrosion
8. Special "cushion" coatings at all joining surfaces

NEWS FROM VICTOR

Victor has more than doubled the area of its ceramic laboratory. The enlarged laboratory affords Victor better, more modern facilities for testing raw materials, controlling quality of production and carrying on basic ceramic research. It was made necessary by Victor's expanding research program now under way.

SPECIFY VICTOR Purified Porcelain Suspensions!

VICTOR INSULATORS, INC., VICTOR, N. Y.
SUBSIDIARY OF I-T-E CIRCUIT BREAKER CO.

Low and High Voltage Pintypes • Suspensions • Guy Strains
Spools • Switch and Bus Insulators • Custom Designed Porcelain
Insulator Hardware

CONTROL BOARD of Sylvania Data Processing Center is demonstrated by A. N. Seares, Remington Rand vice president, to Leon C. Guest, Jr, Sylvania controller

Sylvania Plans Data Center

Sylvania Electric Products Inc has announced plans for the establishment of a company-wide Data Processing Center at one of several sites under consideration. Heart of the system of mechanization to be employed at the Center will be a Univac electronic computing system. Sylvania will lease the Univac from Remington Rand Inc.

Primary objective of the Center is to make all operating information available much more rapidly than it has been in the past. The new data processing program is estimated to save Sylvania "a large sum" in direct costs through more efficient processing.

The company has nine operating divisions, and maintains 45 plants and 12 laboratories in 11 states. Under the new system, the company's various installations will feed financial and production information via an electronic communication network to the Center. Here the data will be instantly summarized for corporate and decentralized management.

Present plans call for construction of the Center to start about May 1, 1955, with partial operation scheduled for January 1, 1956, and full operation gradually attained. When in full operation the Center will handle all Sylvania record processing and keeping, and will employ approximately 300 persons.

A leased communications network will link the center with six area reporting offices. In turn, four to six facilities will report to each area office. The company is making a survey of relative locations of all its divisional headquarters, manufacturing plants, sales offices, warehouses, and other facilities to determine the location of the area offices.

Penn Transformer Offers Oil Pump to Manufacturers

Pennsylvania Transformer Co is making its Seal-Master oil pump available to original equipment manufacturers. Applications are pumping transformer oil and a wide range of industrial oils.

Present integral unit is a centrifugal pump connected to the shaft of a 7.5-hp, 1750-rpm, 3-phase, 220/440-v, 60-cps motor. The pump was designed by the company for use with its forced oil-cooled power transformers. It has given good performance.

Among the features are: sealless construction, self-contained, submersible, self-lubricating, all-position and all-angle operation, portable, and light weight (155 lb). Further information may be obtained from the company, Dept SM, Canonsburg, Pa.

Spanish Firm Orders Westinghouse Gas Turbine

First Westinghouse gas turbine power plant destined for use outside the western hemisphere has been ordered by Manufacturas Metalicas Madrilenas S. A., Spain's largest manufacturer of iron, steel and aluminum products. This announcement was made by J. D. Mickle, general sales manager for Westinghouse Electric International Co.

Complete order, totaling $2 million, calls for a 5,000 kw generating unit, large motors, controls and other electrical apparatus for steel sheet mills at Villaverde, near Madrid. The new equipment scheduled for operation by the end of 1955 will enable the Spanish firm to expand its manufacturing operations from a three-day to a six-day work week.

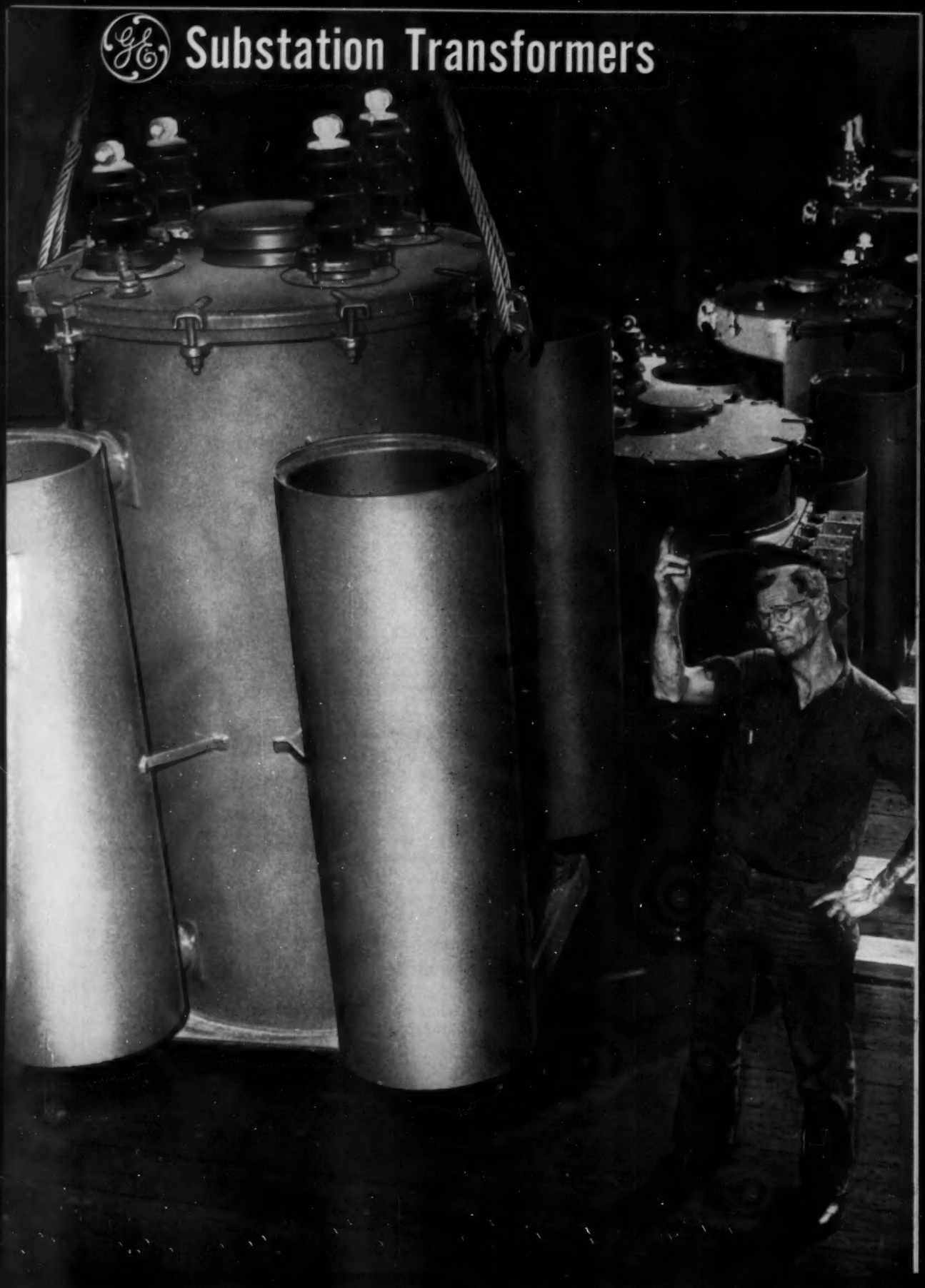
MANUFACTURING BRIEFS

Texas Instruments Inc of Dallas, Texas, has reduced prices 25% on all five types of silicon transistors and more than 30% on both types of silicon junction diodes, because of improved manufacturing techniques.

Handy & Harman, New York 38, N. Y., manufacturer of low temperature silver brazing alloy, points out that silver can be recovered from base metals by a refining service maintained by the firm. Current price is about 80 cents an ounce for the silver.

Crystalheat Co of Van Nuys, Calif, is producing a newly developed Crystalite heating element fused in a perma-tempered glass with a coating to provide additional reflectivity, reports Harry D. Stone, president.

Substation Transformers



Here comes the new look in substation transformers

G-E Chimney Radiators Cut Height 30%, Weight 10%

The new General Electric substation transformer, developed after extensive research on methods of cooling, makes possible important savings in installation and maintenance costs and, in addition, offers increased reliability.

Installation Costs Cut—For example, since height is reduced about 30%, you can install a new 250-kva unit where you now have a 100-kva unit—headroom requirements for both units are the same. This enables you to make sizeable savings because, in most cases, you can install higher rated transformers to meet load growth without enlarging your present installation facilities.

The average 10 per-cent reduction in weight and lowered center of gravity make for easier handling, further simplifying installation.

Maintenance Costs Also Cut—Repainting is easier than with conventional tanks because you paint a few large, smooth surfaces instead of many small, round tubes, complexly arranged.

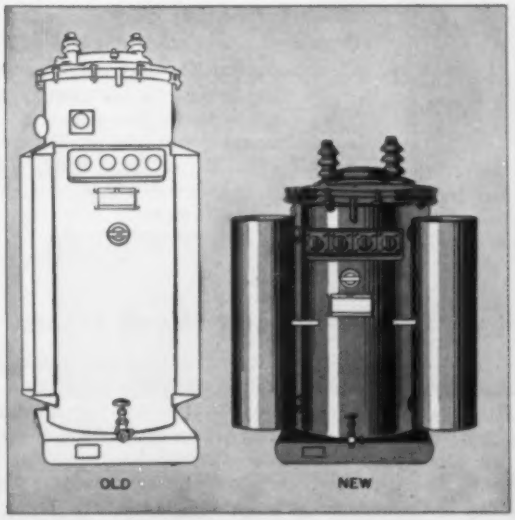
Reliability Increased—Offering the same excellent electrical characteristics as the previous design, chimney-radiator substation transformers are stronger and offer less chance for oil or Pyranol* leaks than conventional units because there are fewer openings into the transformer tank.

Availability—G-E chimney-type substation transformers are currently available in ratings of 250, 333, and 500 kva, in voltages up to 69,000 volts. For further information, write Section 431-14, General Electric Company, Schenectady 5, N. Y.

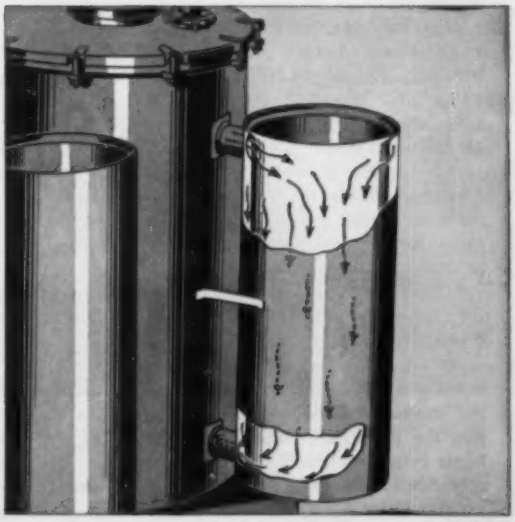
*Reg. Trademark of General Electric Company

Progress Is Our Most Important Product

GENERAL ELECTRIC



CUTS HEADROOM REQUIRED BY ABOUT 30%.—Where clearance is important the new G-E design is a big help because it reduces transformer height as much as 2½ feet.



MORE EFFICIENT COOLING.—The new G-E transformer has four simple, efficient cooling "chimneys." With fewer tank openings, there is little possibility of oil leaks.

Dealers Like Gas

NARDA chief cites survey which shows dealer interest in gas appliances is high

"A great majority of our country's appliance retailers—77½%—anticipate that gas will have an important future as a cooking fuel," Mort Farr, chairman of the board, National Appliance & Radio-TV Dealers Association, told an American Gas Association meeting in Chicago last month.

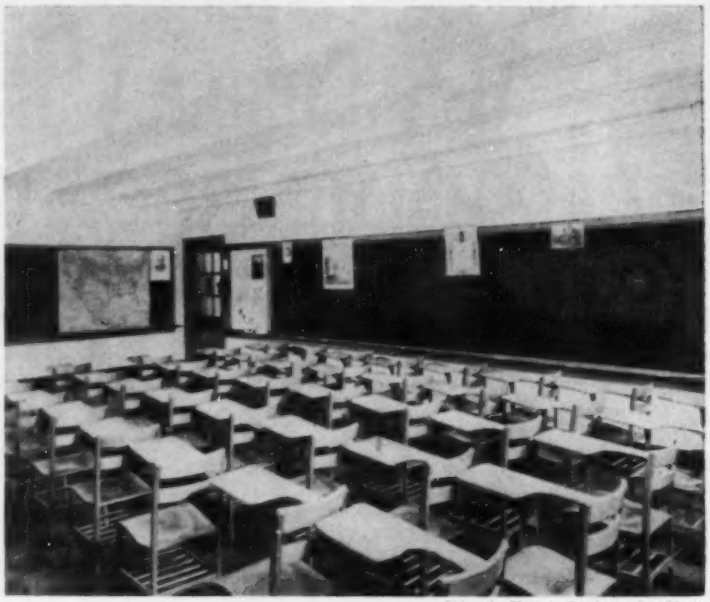
Basing his findings on a national survey of appliance retailers, Farr reported that 25% or less of the total ranges they sell are gas in the case of 30% of the respondents; 19% do between 26 and 50% of their range volume in gas; about one-fifth of them do 51 to 75% and nearly a third do 75 to 100% of their business in gas ranges.

One reason for this dealer interest in gas appliances could be the cooperation they get from gas utilities in promoting them. Farr said that nearly half of the utilities send home service representatives to homes after appliances are sold. Just over a third conduct cooking schools for dealers. About 35% assist in training retail sales people for dealers, and about one-fifth stage floor demonstrations in dealers stores.

High cost of installation was cited as the electric range's principal sales handicap. Economy of initial, maintenance and operating expense were foremost among reasons customers gave for gas range purchases, dealers said. Another bulwark of gas appliances sales is the customer who rents his residence or plans to remain there for a fairly short time. He's reluctant to rewire a temporary home.

Other reasons Farr said dealers gave for consumers buying gas ranges: Familiarity with the fuel, ready flexibility of control on even the lowest models, simplicity of operation, good will engendered by some local utilities, the low rate resulting from the home being gas heated and the widespread belief that gas starts the cooking process faster.

Farr emphasized that NARDA takes no sides in the conflict between cooking fuels.



Sylvania Electric Products, Inc Photo

Illuminated Ceiling Goes to School

Better sight plus better sound is claimed in this Washington, Pa. high school classroom with installation of an illuminated plastic ceiling. The wall to wall corrugated white plastic sheet distributes 65 ft-c of glare-free light evenly over the room. At the same time, room noise is deadened with rows of acoustical wedges (lined with thick fiber pads) which run the length of the ceiling. Already highly popular in stores and offices, the illuminated ceiling permits quick access to service facilities without the necessity of destroying any of the finished structure. Because lighting fixtures themselves are concealed by the ceiling, they can be spaced and mounted where most convenient.

EEI Sales Meet Set for March 28-31

More than 1,000 electric utility sales executives are expected to attend Edison Electric Institute's 21st Annual Sales Conference, March 28-31 in Chicago's Edgewater Beach Hotel. Announcement was made by O. R. Doerr, chairman of EEI's Commercial Division Executive Committee and vice president of Pacific Gas & Electric Co.

Conference begins Monday, March 28, with a full day home service session plus meetings by EEI Commercial Division's 20 committees. On Tuesday, four concurrent group meetings covering selling in the commercial, farm, industrial, and residential markets will be held.

General sessions all day Wednesday, and Thursday morning, will deal with lighting, air conditioning, wiring, and appliance manufacture. Annual presentation of sales promotion awards is slated for Wednesday morning. Conference ends with general luncheon session Thursday.

Philly Wants Lights

Recent announcement that Philadelphia will spend $5 million for a 10-yr street lighting improvement program has brought a flood of pleas for better illumination from neighborhoods throughout the city. "Requests for new lighting have been snowballing to such an extent that we can't possibly fill them," said one Department of Streets employee.

Here's Proof of Performance...

302 pressure-creosoted poles installed in 1928 ... *only one replacement* due to pole failure

CENTRAL HUDSON GAS & ELECTRIC CORPORATION, serving the Mid-Hudson Valley, with General Offices at Poughkeepsie, N. Y., has more than 100,000 pressure-creosoted poles in its system. The company began using pressure-creosoted yellow pine poles in 1926, one of the first lines to be built being the River Transmission Line from Highland to Newburgh, a distance of approximately 16 miles.

This line was installed in 1928 and 1929, using 302 40′-60′ poles. To date, ten poles have been replaced, but only one due to wood failure. Boring tests made recently show the poles are still extremely sound.

In specifying poles, it will pay you to follow this utility's example and rely on Creosote's unmatched records of service. And when you do, be sure your poles are pressure-treated with uniform USS Creosote. Its deep penetration, retention and high toxicity assure you maximum pole life. For complete information, contact our nearest Coal Chemical sales office, or write directly to United States Steel Corporation, 525 William Penn Place, Pittsburgh 30, Pa.

See "THE UNITED STATES STEEL HOUR"—Televised alternate weeks—Consult your local newspaper for time and station.

1929 dating nails on this pole are evidence of the long, economical life of pressure-creosoted poles.

John J. Sotanski, Central Hudson Estimator, inspects pressure-creosoted poles in the company's River Line which have been in the ground more than a quarter century and are still sound, according to recent boring tests.

USS CREOSOTE

SALES OFFICES IN PITTSBURGH, NEW YORK, CHICAGO, CLEVELAND, SAN FRANCISCO AND FAIRFIELD, ALA.

USS

5-220

UNITED STATES STEEL

Electricity Cleans Hen House

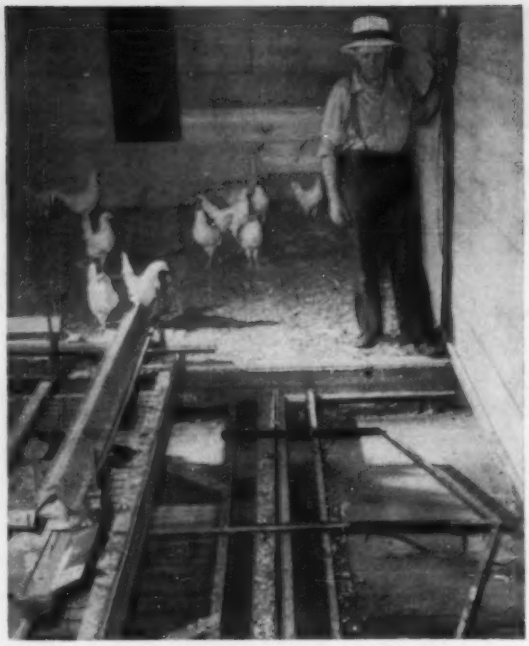
ELDON KOEHLER, Farm Representative, Washington Water Power Co., Coeur d'Alene, Idaho

Cleaner eggs and less chance for poultry disease are benefits Poultry Farmers E. D. and Frank Moser of East Farms, Wash. are getting with their home-made electrically-driven roost cleaner.

Device whisks poultry-droppings from the Mosers' newly-built layer house in just seven min. Frequent cleanings (they use it every three days) reduces moisture within the building by as much as 75%. This big cut in moisture content, they find, makes for added health protection and cleanliness.

To build their cleaner, the Mosers adapted a shuttle-stroke unit originally designed for barn cleaners. It has 14 blades, spaced about 6.5 ft apart, which run in a 1-ft deep, 10-ft wide concrete gutter directly beneath the roosting rack. When in operation, the blades move forward, pushing the droppings before them, for about 8 ft. On the return, they fold upward to pass above the droppings, and then move downward to carry the load forward again. Droppings are moved the length of the building and outside to a concrete pit. There they fall onto a cross conveyor which carries them onto a manure spreader or truck. A 1.5-hp motor powers the cleaner, a ¾-hp unit the conveyor.

All in all, the Moser layer house uses about 12,000 kwhr annually or some 1.6 kwhr for each bird in a total flock of 1,400 layers. House is equipped with automatic feeders, thermostatically-controlled ventilating fans, and incandescent lamps with dimmers.



ROOST CLEANER whisks away poultry droppings in matter of minutes. Adapted by Moser from barn cleaner, it is powered by a 1.5 hp motor.

Factory Lights Doff Overalls

Lighting's versatile standby in the industrial plant, the trolley duct lighting unit, is shedding its overalls and finding its way into the commercial field. Example: J. L. Hudson's new Northland Center in Detroit.

In the center's fine furniture shop, ceiling spotlights can be as easily and quickly rearranged as furniture displays. Duct both feeds and supports the lights. Because it is a continuous electrical outlet, the lights can be moved anywhere along its length. More lights can be added whenever desired without rewiring or wire splicing. This is done by inserting a twistout plug or mobile trolley in the duct's continuous slot and attaching the light. And, points out the manufacturer, you needn't cut off the current to do it.

Trolley duct lighting is finding similar acceptance in a variety of other commercial and institutional applications. At Toledo Art Museum, Toledo, O., the once-strictly industrial units are now putting light on the old masters—El Greco, Rembrandt and Rubens.

The museum's glass ceilings provide proper light during the day, but night lighting presented a problem. Planned artificial lighting was needed. The painting arrangement was changed frequently—requiring rearrangement of lights.

Trolley duct's flexibility was put to work, and now, when exhibits are changed, it is a simple matter to move the lights to suit.

BullDog Electric Products Co Photo

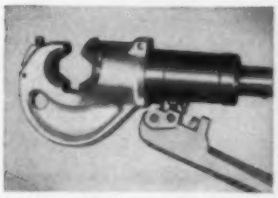
TROLLEY DUCT LIGHTING moves from industrial plant into furniture store where it can be rearranged as quickly as displays it illuminates

ALCOA OFFERS versatile LIGHTWEIGHT 12-TON COMPRESSOR for transmission and distribution line fittings

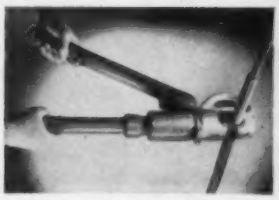
Latest addition to most complete line of aluminum conductors and accessories continues Alcoa's leadership in the field!

12½-pound unit is easily operated without removing hands from the tool handles, an advantage to workers installing wiring at pole tops or in cramped places.

Model 12A compressor has 12-ton thrust for use on ACSR and aluminum conductors as large as 397,500 cm.



C-head holds dies, can be rotated 180° to facilitate easy operation by lineman in limited working space. Hand line may be easily attached to compressor.



Die opening is quickly closed by simple twist of one handle. Minimum effort completes compression stroke. Pressure release trigger, located at grip, automatically retracts dies.

Identical half dies are held in place by tool's head so compressor can be moved along the compression fitting without shifting of dies.

Other features are nylon pump packing, integral pressure relief valve. Normally supplied with neoprene covered body and handles, compressor may be adapted to "hot stick" work.

ALCOA ALUMINUM

ALUMINUM COMPANY OF AMERICA

ALUMINUM COMPANY OF AMERICA
2100-B Alcoa Building, Pittsburgh 19, Pa.
Please send copy of your Fact Folder on Alcoa Model 12A Compressor.

Name_____

Company_____

Street_____

City_____ Zone_____ State_____

handled with care!

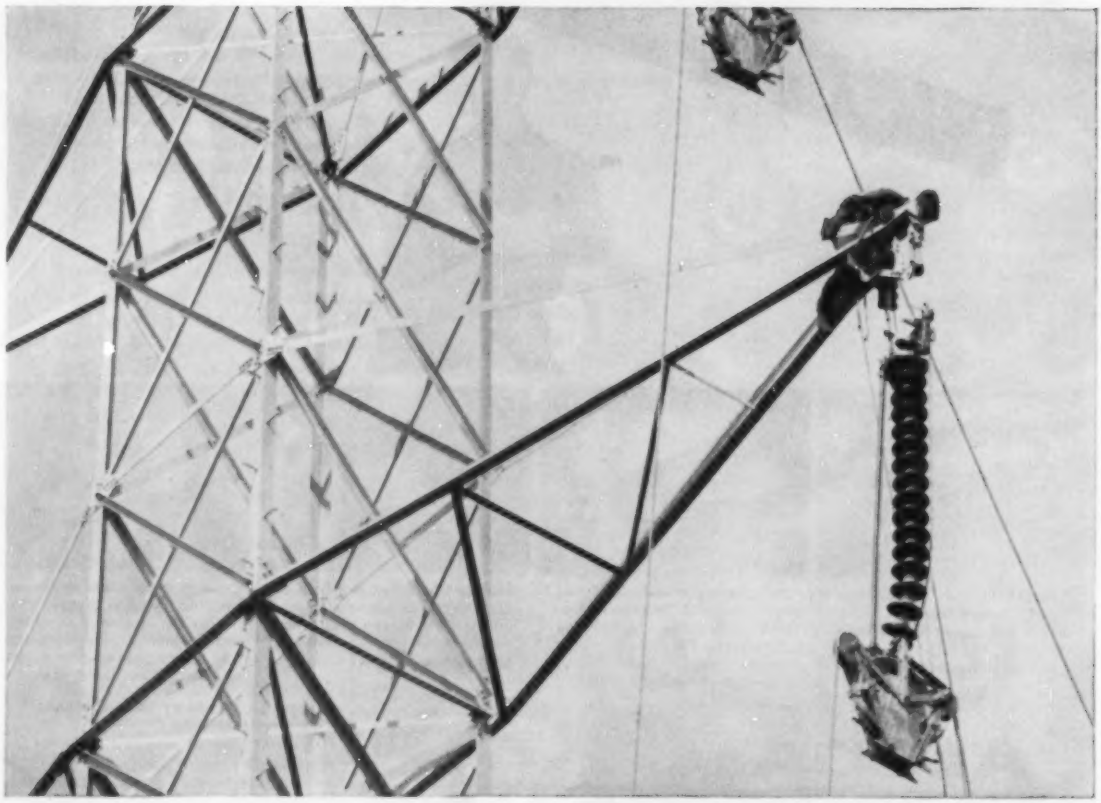
Use of a metal cradle protects those O-B Suspension Insulators while they're hoisted to the cross-arm. Such care shields every insulator from rough treatment; makes sure each string goes into service in factory condition. Careful handling by the builder is only to be expected, after choosing best-quality materials for this 330-kv line. Successful transmission at extra-high voltage depends on first-class materials in first-class condition.

On this job where materials *must* be right, it is significant that O-B Suspension Insulators and hardware are used, just as they have been chosen for use on every other extra-high voltage transmission line operating or under construction in the Americas! Ohio Brass Company has earned this confidence for its products in a half-century of design and production of insulation of the highest character.

Ohio Brass Company • Mansfield, Ohio

Ohio Brass

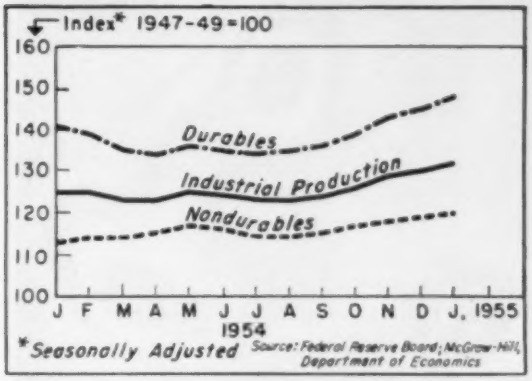
4544-H



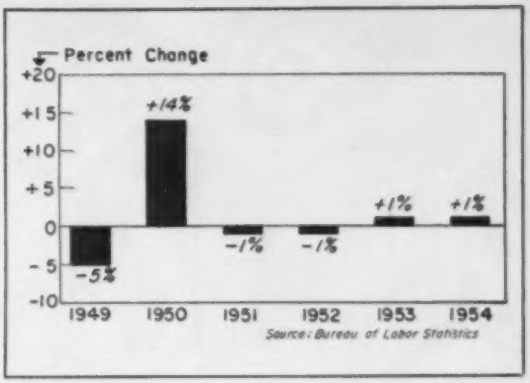
Simple, sensible protection delivers O-B Suspension Insulators to the crossarm in factory condition.

ELECTRICAL BUSINESS OUTLOOK

Does Fast Recovery of Production . . .



. . . Mean Inflated Wholesale Prices?



Inflation Lurks Behind Business Boom

The recent course of human events has aroused a spector that had been lying low for a couple of years—the threat of an inflationary boom in the economy.

On the surface, a lot of obvious factors point to renewed inflation. One of these is the Far Eastern situation. In the past, the sound of guns going off has often started a wave of price increases. Another is the stock market, where gains have caused general talk of a boom.

But the chief element in threatening inflation is the very rapid rise in industrial production and some of the other key economic indicators. For example:

1. Industrial production has risen to about 132 on the Federal Reserve Board's index, up from the low of 123.
2. Housing starts averaged about 1.5 million a year in December, 300,000-400,000 above the rate last summer.
3. Automobile production in January hit 650,000 units—two hundred thousand more than in January, 1954.
4. Gross national product jumped $5.5 billion in fourth quarter 1954, biggest increase since second quarter 1953.

Higher Wage Demands Add Pressure . . . All these things—from Formosa to the busy homebuilder in a Chicago suburb—add to increased demand for raw and finished materials. Rising business activity also promises more pressure from trade unions for higher wages.

And there certainly will be some price increases. Utilities already have seen copper and aluminum move up because of demand pressure, strikes, and higher producer's costs. Steel may follow if the steelworkers get a substantial wage increase at midyear.

But—in spite of these signs—it still seems probable that the inflationary fires will be kept under pretty good control through the year, unless the Far East should go up in smoke or businessmen begin more speculative building of inventories. Here are two good reasons for thinking so:

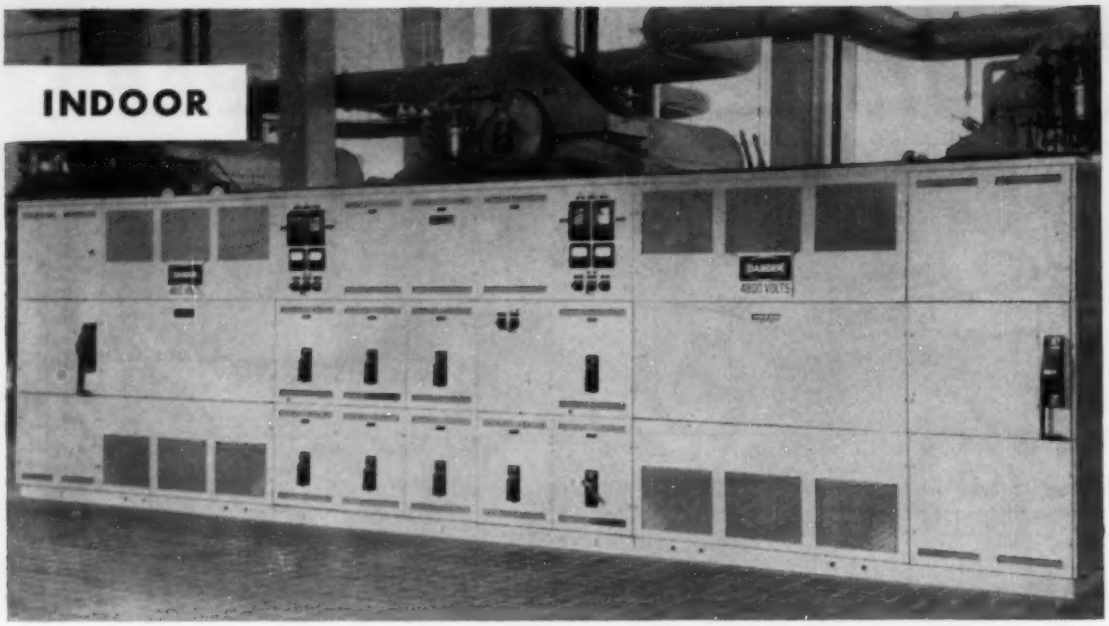
The boom in the two industries that are giving United States business a big shove upward—homebuilding and automobiles—is the product of special situations. There's good reason to expect activity in these industries to slow down a bit as 1955 moves along.

Auto production, for instance, is currently pushed up by three factors. One is enthusiastic consumer acceptance of the redesigned 1955 models. Another is bitter competition to get and hold a bigger share of the new car market. And the third is the threat of an auto workers strike this spring; companies apparently don't want to be caught with no cars to sell if there is a strike.

Competition May Hold The Lid Down . . . The first two factors—consumer buying and competition—will help keep production up all year. But the third—preparation for a strike—will disappear this spring. When it does, auto production is likely to slow down.

As for housing, it's booming partly because of the business upturn, but largely because of the new, ultra-mild credit requirements for home financing. But it's likely to run into a shortage of materials and perhaps of mortgage money later in the year. And that could hold the pace down somewhat.

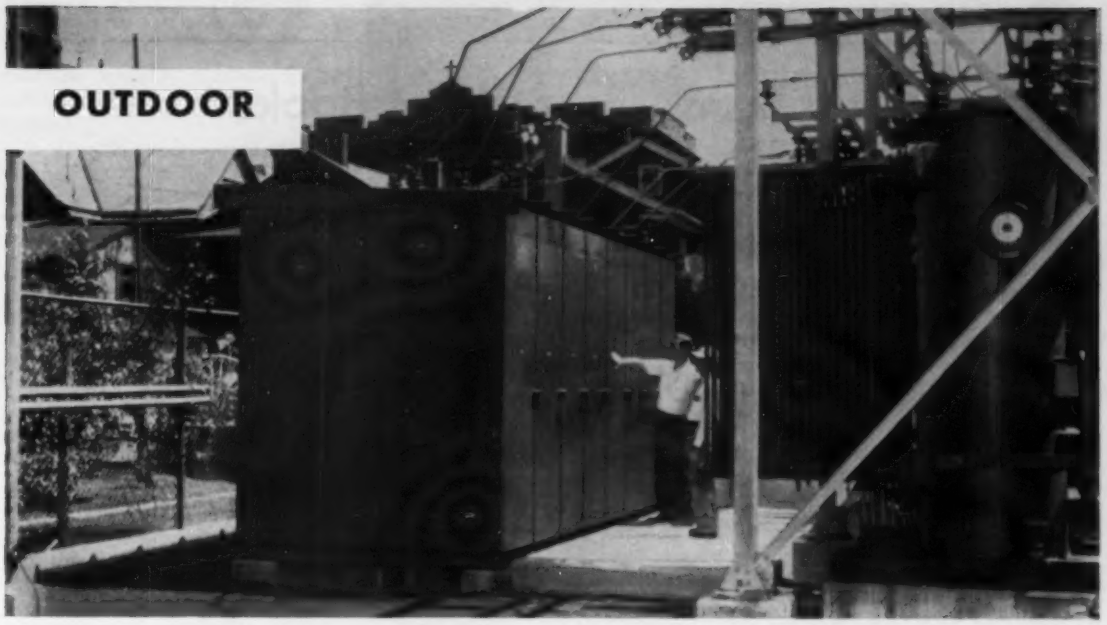
The other chief reason for expecting inflation to stay under control lies in the tremendous increase in American productive capacity of the past few years. This capacity is now about 30% greater than it was at the end of 1950, when the Korean war helped cause an inflationary boom. This huge increase in capacity has brought with it a powerful force opposing inflation—vigorous competition. And one of the ways to sell is to keep prices down, a factor that can be most effective in dampening inflation.



I-T-E, SINGLE SOURCE OF SUPPLY

Primary Section: Maximum protection on the primary side is assured with I-T-E Power Air Circuit Breakers. As an alternate to circuit breakers, roof bushings, throats, terminal chambers, oil cutouts, liquid disconnect switches or air interrupter switches may be furnished.

Transformer Section: I-T-E can supply any type of transformer required for a particular installation. It can be either liquid filled, nitrogen sealed, or dry type. All transformers match and line up with the primary and secondary sections to create one complete unit.



FOR COMPLETE UNIT SUBSTATIONS

Secondary Section: The secondary section consists of I-T-E switchgear. Completely interchangeable, horizontal drawout air circuit breakers are housed in a sturdy structure with completely isolated compartments, large rigidly braced bus, and a superior exterior finish.

You can buy a unit substation either of two ways: a piece at a time (the expensive way), or all at once (the economical way). I-T-E can sell you the individual elements, but recommends that substations be purchased complete, and from a single source of supply.

There are good, practical reasons for this. I-T-E's engineering assistance in over-all planning, floor layout, and choice of elements is more valuable to you when it covers the complete substation. Units are packaged and shipped ready to install without delay or complications.

There are further advantages in knowing that one dependable company stands behind your complete installation, and that all parts are designed to function as a unit.

I-T-E Primary and Secondary Unit Substations can be supplied for any application: indoor and outdoor, and in any standard rating. For details, contact the I-T-E sales office nearest you. Look in your classified directory under "Electric Equipment." I-T-E Circuit Breaker Company, Switchgear Division, 19th & Hamilton Sts., Philadelphia 30, Pennsylvania.

I-T-E CIRCUIT BREAKER COMPANY
Switchgear Division

IN THE INDUSTRY

Big vs Little Dams—a Battle of Books

One recently published book glorifies the big dam. Another glorifies the small, farm-type dam. You won't find a point-by-point conflict between the two books, but you will find some interesting and pertinent reading in both.

The more recently published book, "Big Dam Foolishness," by Elmer Peterson (The Devin-Adair Co; 224 pp, $3.50), is a ringing plea for small, farm-type, water retention structures and soil treatment that will hold rain where it falls. It is, at the same time, an outraged harrangue against the multi-million dollar, multi-purpose basin development schemes of the Corps of Army Engineers.

Small Dam Advocate . . . In his relatively short, easily readable book, Peterson makes clear that his treatise is directed at flood control and soil saving practices in the prairie states of the Middle West. He can see some justification for large dams on mountain streams but thinks that such projects as Grand Coulee dam are not prudent if developed primarily as irrigation projects.

The other book, "Hail Columbia," by George Sundborg (Macmillan Co; 467 pp, $5.75), has no doubts about the value or the wisdom of Grand Coulee dam. Here in this long, sometimes repetitious, book is the story of the political in-fighting, the nagging defeats, and the eventual victory of a band of would-be irrigators seeking construction of the world's largest man-made structure.

"Hail Columbia" neither is nor claims to be a learned treatise on big dams. It is more of a dull documentary on the personal struggles of the men who fought the battle for federal funds for Grand Coulee. In places it rises to nearly heroic heights in describing the fight of James O'Sullivan, who is pictured as the real author of the Grand Coulee plan.

The villains of "Big Dam Foolishness" are the Corps of Army Engineers, the "dollar socialists" pushing federal power development, and all the others who espouse the idea of big, main-stem, multi-purpose dams in the Mid-West plowlands. To author Peterson these forces are draining off the life-giving elements of the nation's agricultural soil.

Villians and Heroes . . . Heroes of Peterson's book are the specialists of the Soil Conservation Service and the farmers who demonstrate the effectiveness of the soil-treatment, small-dam process of stopping floods before they start. These men are pictured as the saviors of America's agricultural heritage. Peterson holds that flood control is a land use problem and all policies pertaining to it should be under the U. S. Agriculture Department.

The villains of "Hail Columbia" are the electric companies of the Pacific Northwest, the Federal Power Commission, and others who for engineering, economic, social, or other reasons hampered or delayed the multi-million dollar Grand Coulee. Author Sundborg makes no attempt to understand or evaluate the arguments against the tremendous undertaking. For that reason the conflicts of philosophies and ideologies which might have lent depth to the book were passed over in the mad rush to build the mighty Coulee within the 467 pages.

"Hail Columbia" is a hymn of praise for the project and for its backers led by O'Sullivan. It makes little difference to Sundborg whether the structure is primarily for power or primarily for irrigation. Its backers, always led by O'Sullivan, pushed it on whichever terms appeared most opportune at the time.

There is no urgency to Sundborg's book because Grand Coulee is an accomplished fact.

Peterson Is a Crusader . . . Not so with Peterson's book for the author is crusading for a new national policy on water conservation. The main stem, multi-purpose dams, he argues, are giving the public a false sense of security. The power dams of the propaganda movies show only the "flying dramatic spray that billows from the flumes or spillways." They do not show the life-giving minerals and humus washed from the rich agricultural soils. Nor do the movies show the silt fall-out behind the dams that will eventually render them useless.

A curse on all the big dams that rob the farm lands of their precious top soil, says Peterson.

"Hail Columbia," says Sundborg.

TECHNICAL NOTES

Fray threads of glass tape covering through-leads of a dry-type bushing can cause radio interference voltage if they extend into the air space between the conductor and the porcelain shell.

Bottom ash handled from pressurized furnaces may be small in quantity, but skimpy handling equipment can prove to be bad economy if clogged hoppers lead to a boiler outage.

A new aluminum alloy matches the yield strength of silver-bearing copper for generator fields because it has high recrystallization temperature and superior resistance to relaxation and creep.

Special non-leaded white gasoline with low gum content has been used to prevent carburetor fouling of gasoline engine-driven generators supplying standby power for microwave systems.

Zero-sequence impedance measurement of pipe-type cable made with the three conductors in parallel gives practically the same value of impedance as would the same total current in only one conductor.

Atomic Energy Hearing

(*Continued from page* 10)

contracts primarily for research or development or for operation of a facility;

2. Type B, which is used where a contract relates to a general field of activity, and which gives the contractor retention of a nonexclusive license in fields other than production or utilization of special nuclear materials;

3. Type C, which allows the contractor to retain a sole license with sole sublicense rights, is used where the contractor has an established industrial and patent position and his work is only incidentally related to AEC research and development programs; and

4. Type C-Plus, which provides that inventions will be the property of the contractor under a study agreement, except that the government shall have access to the patented article or process.

AEC plans to retain its "C-Plus" clause for study agreements, and to incorporate it in its access agreements and commercial agreements. Contractors will retain full rights to unclassified developments which do not involve AEC funds, facilities or data.

Compulsory Licensing Favored . . . The agency said it still is in favor of retaining its right to compulsory licensing of patents developed by private individuals or firms who have a "relationship" with AEC.

• **Hazards**—Reactor hazards and insurance present quite a problem, of course. To keep these under close scrutiny, AEC's Advisory Committee on Reactor Safeguards considers each reactor in relation to its surroundings as a special problem.

• **Training**—Basing estimates on the forecast that 12 million kw will be generated by atomic energy in 1975, AEC said it anticipates a need by then of 40,000 scientists and engineers for atomic energy work. To achieve this, its training program must be increased by 1975 to an annual level of 4,000 new scientists and engineers a year.

• **Inspection**—AEC's new Inspection Division will investigate all questions of employees' conduct and fraud in AEC and contractors' organizations, ascertain that adequate management appraisals are developed and carried out, inspect licensees' facilities.

Buckley Is Presented Edison Medal

Presentation of the Edison Medal to Oliver T. Buckley, retired president of Bell Telephone Laboratories, Inc, took place at the American Institute of Electrical Engineers' Winter General Meeting held recently in New York. Buckley (center) is pictured above accepting the award from AIEE Pres A. C. Monteith. James F. Fairman, (left) vice president of Consolidated Edison Co of New York, Inc, witnessed the presentation. Buckley was cited for his contribution to a trans-Atlantic telephone cable, leadership of a great industrial laboratory, and services to the government.

WASHINGTON CHECKLIST

Utilities Investigations — Chairman Warren Magnuson (D-Wash.) of the Senate Interstate Commerce Committee said $22,000 in funds just voted his unit for business regulatory investigations will be used for "matters under Federal Power Commission control . . . perhaps certain power dams in the West."

Public Works—House Public Works Committee has been raised to 34 members. Reps Clark (D-Pa.), Dwight Rogers (D-Fla.) are new members. Filo Sedillo, Belen, N.M., and John L. Mutz, Albuquerque, have been named chief clerk and staff director of Senate Public Works Committee.

Atomic Energy—Atomic Power Development Associates has determined it can successfully build a 100,000-kw nuclear power plant. It would cost at least $50 million, and would be uneconomic to start with. The group has not yet decided whether or not it will submit a proposal to AEC.

AEC has named Curtis A. Nelson director of the Inspection Division. Division is "responsible for gathering information to show whether or not the contractors licensees, and officers and employees of the commission are complying with" Atomic Energy Act.

Tennessee Valley Authority—TVA said President Eisenhower has approved its allocation of investment in multi-purpose projects: Navigation 27%, flood control 31%, power 42%. When single-purpose activities are included the breakdown is, navigation 12.4%, flood control 14.4%, power 73.2%.

Bills Introduced

Upper Colorado—To authorize the project, (HR 3383).

Water Control—(HR 3403) (S 863).

FINANCE AND REGULATION

Utah Company Receives $69,648 Year Rate Hike

The Utah Public Service Commission has granted the Southern Utah Power Co a $69,648 a year rate increase requested by the Western utility for its Cedar City power system.

In the determination of the rate base, while the PSC used net original cost, it did allow an amount for materials and supplies and also cash working capital based on 45½ days operating expenses, exclusive of purchased power. Whether this allowance for working capital establishes a precedent or not is an interesting point to consider.

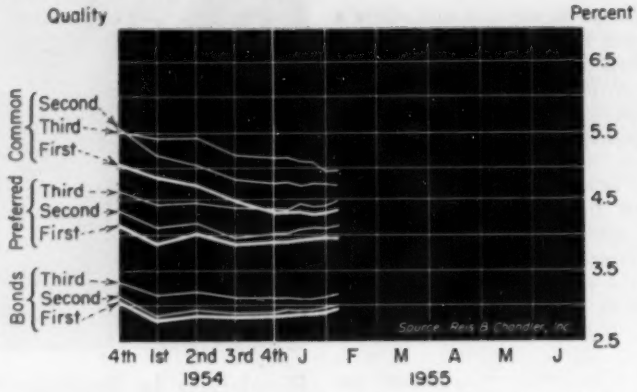
As to the rate of return, this was found to be 4.35% for the Cedar system while the company's requested increase would bring this return up to 5.11%. The PSC noted that "The additional revenues requested by the company will improve its earnings considerably but the rate of return which those earnings will produce . . . will be below that normally necessary for an electric utility."

However, as to distribution of the increase in rates, which the company had proposed to assign to irrigation service, large industrial customers, street lighting, a rural cooperative and two towns, the PSC said that it ". . . is not convinced at this time that the schedule of rates proposed by the company at the hearing of this matter would be equitable and reasonable. We think the question should be explored further."

FINANCIAL BRIEFS

Increased Common Dividends . . . Houston Lighting & Power Co will pay March 10 a quarterly dividend of 5% in stock and the regular 30¢ in cash. New stock will participate in the cash dividend . . . Black Hills Power & Light Co will pay March 1 a quarterly dividend of 34¢ a share as compared with 32¢ in the previous quarter . . . Iowa Electric Light & Power Co will pay April 1 a quarterly dividend of 31¼¢ a share versus 30¢ previously.

Today's Utility Yields—(%)



	BONDS			PREFERRED STOCKS			COMMON STOCKS		
QUALITY.....	1st	2nd	3rd	1st	2nd	3rd	1st	2nd	3rd
Feb. 3.....	2.96	3.00	3.13	3.96	4.08	4.41	4.31	4.68	4.90
Jan. 27.....	2.93	2.98	3.12	3.98	4.09	4.41	4.33	4.75	4.97

Utility Earnings

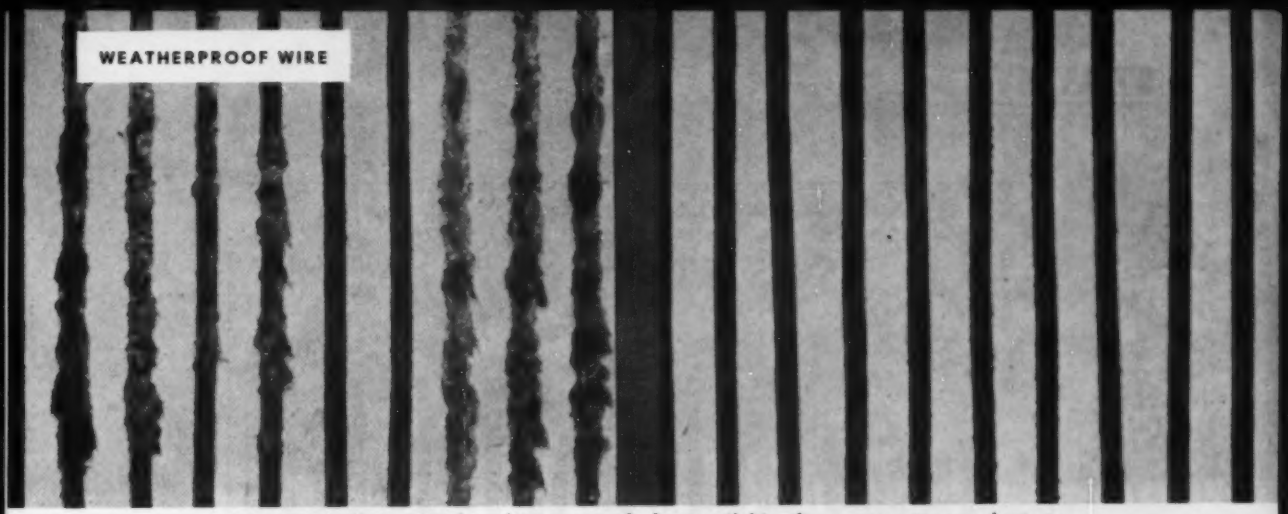
COMPANY	PERIOD MONTHS ENDED		NET INCOME 1954	NET INCOME 1953	EARNINGS PER COMMON SHARE 1954	EARNINGS PER COMMON SHARE 1953
Alabama Power.....	12	Dec.	$13,046,300	$13,165,270	$....	$....
Central Hudson Gas & Electric.	12	Dec.	3,220,607	2,781,124	0.95(a)	0.90(a)
Consolidated Gas EL & P.....	12	Dec.	12,141,000	10,142,000	1.95(b)	1.74(b)
Kansas City Power & Light....	12	Dec.	7,129,897	6,521,293	2.33(c)	2.42(c)
Long Island Lighting.....	12	Dec.	9,242,126	7,732,803	1.29(f)	1.28(f)
New York State Electric & Gas.	12	Dec.	9,382,952	9,053,537	2.58	2.54
Ohio Edison and subsidiary....	12	Dec.	20,270,680	19,328,745	3.02(g)	3.15(g)

Notes—All the figures for the companies are subject to year-end audit; (a) Based on 2,633,956 shares in 1954 and 2,259,642 shares in 1953; (b) Based on 5,758,561 shares in 1954 and 5,276,786 shares in 1953; (c) Based on 2,450,000 shares in 1954 and 2,224,540 shares in 1953; (f) Based on average number of shares; (g) Based on 5,806,136 shares in 1954 and 5,278,306 shares in 1954.

Utility Financing

COMPANY AND DESCRIPTION	AMOUNT OF OFFERING (000)	OFFERING PRICE	YIELD TO PUBLIC
SCHEDULE FOR FEBRUARY			BID DATE
BONDS AND DEBENTURES			
Dallas Power & Light-debs due 1980	$7,000	.....	Feb. 14
Kansas City Power & Light—1st mtg due 1985	16,000	.....	Feb. 15
Central Electric & Gas-conv. subord debs due 1970	1,500	.....	Feb. 17(a)
Texas Electric Service—1st mtg due 1985	17,000	.....	Feb. 23
Rochester Gas & Electric-1st mtg due 1985	10,000	.....	Feb. 24
PREFERRED STOCK			
Carolina Power & Light—50,000 sh serial cum no par	$.....	.....	Feb. 23(b)
COMMON STOCK			
Carolina Power & Light—505,000 sh	.....	.....	Feb. 23(b)
South Carolina Electric Gas—210,053 sh (to be offered commonholders on a 1-for-15 basis, record Feb. 24 to expire Mar. 10 with oversubscription privileges. Owners of less than 15 shares can subscribe to one full share)	.....	.....	.....

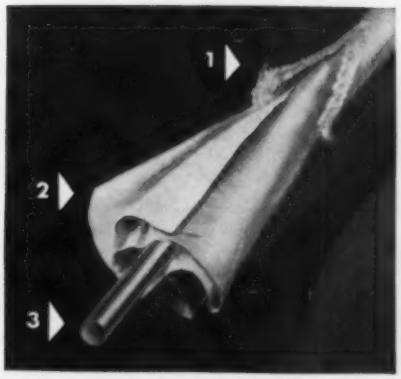
Note—(a)Paine, Weber—Stone & Webster group, underwriters; and (b) Merrill Lynch, Pierce, Fenner & Beane—R. S. Dickson & Co, group, underwriters.



Unretouched photographs show that some standard types (left), after severe aging test, begin to come apart and festoon. Duraline (right), after similar severe aging, remains completely weathertight.

Anaconda's exposure rack at Hastings on Hudson, N. Y., used to study effects of *natural aging* on wire and cable coverings.

"Test of time" proves—you save money with Duraline



***Only Anaconda* makes Duraline. 1.** Outer braid, URC saturated and finished. Experience shows this covering gives best weather protection. **2.** Note *continuous* sheath of interlocked and felted, fibrous material. Water cannot "wick" through it. **3.** Copper, aluminum or copperweld conductor.

21 years on the torture rack and still no festooning

In 1934, hundreds of feet of Duraline* were installed on special outdoor racks at Anaconda's plant on the Hudson River.

In the 21 years since, this wire has been subjected to the most corrosive conditions possible: acrid smoke, salt mist, rain, scorching sun, ice and sleet.

Today this wire is as good as new. It shows absolutely no sign of deterioration . . . and what is more important, not the slightest sign of future festooning!

Duraline has passed the "Test of Time." Time has proved this weatherproof wire won't festoon . . . that it reduces grounds and shorts in wet, windy and icy weather. This trouble-free service saves money — enough to pay for Duraline over and over again. See your Anaconda Distributor or Salesman today. Anaconda Wire & Cable Company, 25 Broadway, New York 4, N. Y.

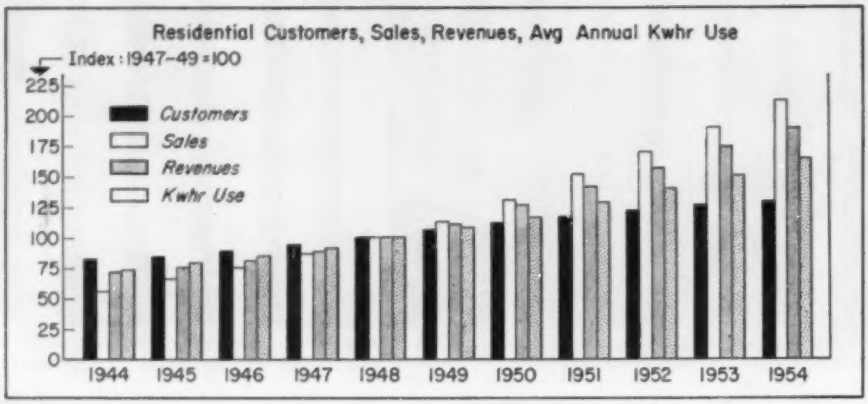
55281

*Reg. U. S. Pat. Off.

DURALINE weatherproof line wire

ANACONDA®

STATISTICS



Power Statistics . . .

		Latest Month	Preceding Month	Year Ago	Annual Change %
Capacity	Dec.	102.52	110.12	91.49	12.1
Peak—Class I Systems.. million kw.....	Nov.	81.9	79.9	75.3	8.8
Estimated Dec. '55 Peak	Nov.	96.1	96.2	98.3	− 2.2
Production—billion kwhr.....	Nov.	40.22	40.46	36.43	10.4
hydro.....		8.12	7.83	6.99	16.4
fuel.....		32.10	32.63	29.44	9.0
Sales—billion kwhr	Nov.	33.87	33.75	31.59	7.2
residential.....		10.07	9.70	9.02	11.5
commercial.....		6.14	6.40	5.50	8.8
industrial.....		15.38	15.24	14.95	4.5
other.....		2.29	2.41	2.12	7.5
Fuel Consumption.....	Nov.				
coal—million tons.....		10.70	10.34	10.19	3.5
oil—million barrels.....		5.82	5.32	6.91	−15.8
gas—billion cu ft.....		88.66	108.49	80.58	10.0
Net Income Class A & B Co's—$ million....	Nov.	94.91	86.98	83.86	13.2
Residential Customers—millions.....	Nov.	43.04	42.95	41.89	2.8
revenue per kwhr.....		2.70¢	2.70¢	2.74¢	− 1.5
avg. kwhr per customer.....		2,528	2,512	2,332	8.4
avg. annual bill.....		$68.26	$67.82	$63.90	6.8

Business Statistics . . .

Indexes: 1947—49 = 100					
FRB Industrial Production.....	Dec.	128	130	124	3.2
ENR Construction Cost.....	Jan.	135.1	134.9	128.7	5.0
BLS Cost-of-living.....	Dec.	114.3	114.6	114.9	− 0.5
NEMA Sales	Nov.				
insulation materials.....		124	117	130	− 4.6
electric appliances.....		90	102	70	28.6
household refrigerators.....		47	51	35	34.3
Wholesale prices	Dec.				
motors and generators.....		121.7	121.7	124.3	− 2.1
transformers and regulators.....		128.1	128.1	128.1	.....
switchgear and fuses.....		135.3	135.3	135.1	0.1
GNP—annual rate—$ billion.....	3rd qtr.	355.5	356.0	367.2	− 3.2

FOLLOW THE SIGN OF QUALITY

MOLONEY ELECTRIC

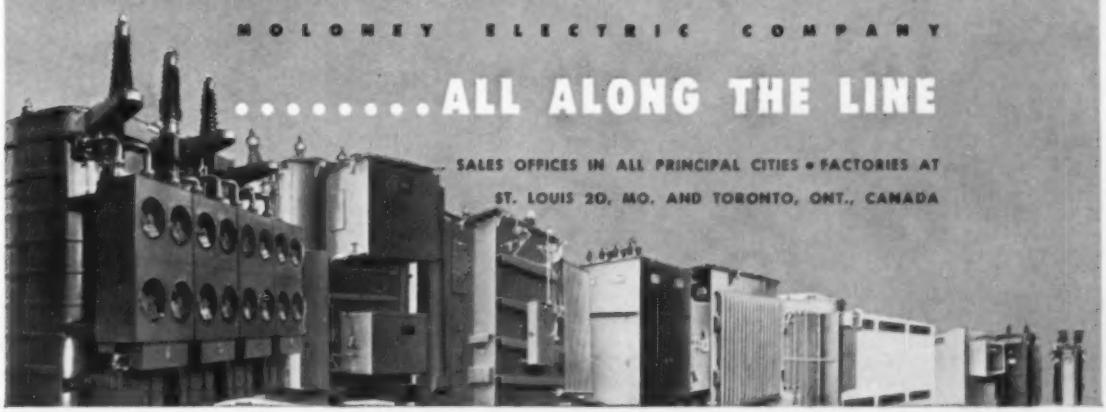
Follow the "Sign of Quality" . . . all along the line. From the largest power transformers . . . thru primary and secondary substations . . . thru distribution transformers . . . to the consumer's door, Moloney Transformers are dependably handling the ever growing utility load.

This has not come about by chance. Utility system planning encompasses and accurately measures today's demands . . . and tomorrow's. Operating records of equipment used in years past; plus today's facilities and engineering for tomorrow's needs . . . has done much to encourage the purchase of Moloney products. Here, at Moloney, it is gratifying to know that almost invariably the purchase of a Moloney Transformer by a utility means a repeat order when the need arises for more equipment. Moloney Transformers will add *dependability* to your system . . . all along the line.

MOLONEY ELECTRIC COMPANY

.....ALL ALONG THE LINE

SALES OFFICES IN ALL PRINCIPAL CITIES • FACTORIES AT ST. LOUIS 20, MO. AND TORONTO, ONT., CANADA



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Only in Mechanically Trip-Free breakers are contacts and mechanism uncoupled... enabling contacts to open without restriction from mechanism.

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